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DARLINGTON LEAK BEFORE BREAK
MATERIAL TEST PROGRAM
J-RESISTANCE CURVES
VOLUME 2 - TEST METHODS AND RESULTS

Report No. 87-103-K

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ABSTRACT

The Darlington Leak Before Break (LBB) approach has been developed for large diameter (21, 22, 24 inch) heat transport (HT) piping because of the difficulties encountered in attempting to provide pipewhip restraints and in recognition of the questionable benefits of providing such restraints. Ontario Hydro's LBB approach is based on elastic plastic fracture mechanics (EPFM) methods. Specifically, the J-integral/tearing modulus (J/T) method has been used. This approach has been selected as it is a general procedure that incorporates a rational crack tip parameter J, can discriminate between materials of different toughnesses and tensile properties and can incorporate various boundary conditions (e.g., load vs. displacement control) and pipe system characteristics (e.g., system configuration and support characteristics).

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In order to assess the stability of HT piping in the presence of hypothetical flaws, the material value of J associated with crack extension, which is also known as a material resistance curve or a J-R curve, must be known. In the Darlington LBB material test program J-R curves were determined from actual Darlington NGS-A large diameter heat transport piping, forgings, welds and heat affected zones. Volume one of this report includes a summary of test results and major conclusions. Volume two of this report describes the test method, calculation and interpretation of results and documents all experimental test data for archival purpose.

The entire data set is stored in a data base in the Mechanical Design Department's VAX computer for quick access and for application to the Darlington LBB project.

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EXECUTIVE SUMMARY

DARLINGTON LEAK BEFORE BREAK
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J-RESISTANCE CURVES
VOLUME 2 - TEST METHODS AND RESULTS

B. Mukherjee and D.W. Carpenter
Nondestructive and Fracture Evaluation Sectio
Metallurgical Research Department

The Darlington Leak Before Break (LBB) approach has been developed for large diameter (21, 22, 24 inch) SA106B heat transport (HT) seamless piping because of the difficulties encountered in attempting to provide pipewhip restraints and in recognition of the questionable benefits of providing such restraints. Ontario Hydro's LBB approach is based on elastic plastic fracture mechanics (EPFM) method.

In order to assess the stability of HT piping in the presence of hypothetical flaws, the material value of J associated with crack extension, which is also known as a material resistance curve or a J-R curve, must be known. In this test program, J-R curves were determined from actual pipe heats that were used in the construction of the Darlington heat transport systems (Units 1 and 2). Welded specimen test blocks were prepared using the four different welding procedures employed for nuclear Class I piping. Two SA105 vesselet forgings were also tested.

The test program was designed to take into account the effect of various factors such as test temperature, crack plane orientation, welding effects, etc, which have influence on fracture properties. The objective was to identify these factors which tend to lower the resistance curves and apply the appropriate lower bound resistance curves that were obtained from this program for structural analyses. A total of 91 tests were conducted, and this report describes the test method, calculations and interpretation of test data, specimen configuration, dimension and preparation and documents all experimental test data for archival purpose.

The entire data set is stored in a data base in the Mechanical Design Department's VAX computer for quick access and for application to the Darlington LBB project.

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To

Mr. M.A. Machacek
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DARLINGTON LEAK BEFORE BREAK
MATERIAL TEST PROGRAM
J-RESISTANCE CURVES
VOLUME 2 - TEST METHODS AND RESULTS

1.0 INTRODUCTION

Ontario Hydro has developed a leak-before-break (LBB) methodology for application to the large diameter heat transport piping for Darlington NGS A because of the difficulties encountered in attempting to provide pipewhip restraints and in recognition of the questionable benefits of providing such restraints. This approach has been developed for pipe sizes which are equal to or greater than 21 in. nominal diameter. (However, the basic approach and the underlying theories are applicable to smaller pipe sizes equally well).

The Ontario Hydro leak-before-break approach is based on the J/T method. This approach has been selected as it is a general procedure that incorporates a rational crack tip parameter. On the material side it can discriminate between materials of different toughness and tensile properties. On the structural side it can include various boundary conditions (e.g., load vs. displacement control) and pipe system characteristics (e.g., system configuration and support characteristics).

There are two critical steps in a leak-before-break analysis, which are initiation or first extension of a hypothetical flaw and stability of a growing flaw subsequent to initiation. The material value of J associated with initiation is J_{Ic}. If the applied value of J is less than J_{Ic} then initiation or significant extension of a crack will not occur and the stability of an existing crack is ensured automatically. When crack extension is predicted, the amount of extension must be evaluated to determine if this extension would occur in a stable manner. The material value of J associated with crack extension which is also known as material resistance curve or a J-R curve is required for stability assessment. The nondimensionalised slope of a J-R curve at a given value of J is defined as tearing modulus (T). The margin against instability is determined from a J-T plot where J is plotted against T for the material and the structure.

In this Darlington leak-before-break material test program material J-R and J-T curves were determined from actual Darlington NGS A large diameter heat transport piping, forgings, associated welds and heat affected zones. The first volume of this report includes a summary of the test method and results and major conclusions. The second volume of this report describes the test method, specimen selection and configuration, calculation and interpretation of results and documents all experimental test data for archival purpose.

The ASTM test procedure E813, Test for J_{Ic}, a Measure of Fracture Toughness/1/ and a proposed ASTM method, Standard Test Method for Determining J-R Curves/2/ were used. A single specimen technique was utilized to determine the J-R curves. In this test method, crack length and crack extension were determined from elastic compliance measurements. These measurements were taken on a series of unloading/reloading segments spaced along the load-versus-displacement record. A personal computer was used for test control and data acquisition/3/. It controlled the loading and unloading sequences and inserted a one minute hold time before each unloading to minimize the effect of stress relaxation. The J-R curve consists of a plot of J versus crack extension, in the region of J-controlled growth. Each single specimen test was repeated two or three times for every test condition (see Table III).

A closed loop servohydraulic testing machine was used to conduct the tests. A clevis and pin arrangement was used to grip compact tension specimens. Displacement measurements were taken on the load line using a high temperature capacitance displacement gauge. The load and displacement measurements are needed for two purposes: to evaluate J from the area under the load versus load line displacement record and, for the elastic compliance method, to calculate crack extension, a_p, from elastic compliance calculations.

2.0 SPECIMEN CONFIGURATION, DIMENSION, AND PREPARATION

The test program was designed to take into account the effect of various factors which have an influence on fracture properties. The objective was to identify those factors which tend to lower the resistance curves and apply the appropriate lower bound resistance curves that were obtained from this program for structural analyses. Factors which were studied in this project were:

Pipe size and product forms;

Heat of piping material;

Crack plane orientation;

Temperature;

Welding effects.

2.1 Heat Transport Pipe Sizes Tested

Three different pipe sizes (12, 22 and 24 inch NPS) of SA-106 Grade B were used. Two SA-105 vesselet forgings (22 x 12 inch NPS) were also tested. "Vesselet" is a trade name for a weld-in contour fitting. Note that many of the large diameter piping elbows are hot bent from straight pipe of SA-106 Grade B material and then reclassified as SA-234 WPB.

2.2 Heats of Large Diameter Piping Tested

Piping material from actual pipe heats that were used in the construction of the Darlington heat transport system (Units 1 and 2) were tested. Table 1 lists all the heat numbers of large diameter piping employed in Darlington NGS A Units 1 and 2. Appendix A describes the procedure for preparing the test coupons. It identifies the weld procedure and the heats that were used in preparing the weld samples. It also identifies the coupon numbers and their locations for all weld and parent material samples. Refer to Appendix A and the table of test matrix (Table III) to see how the various heats and associated welds were included in the testing.

2.3 Crack Plane Orientation

The identification scheme outlined in the ASTM specification E399 Plane-Strain Fracture Toughness of Metallic Materials/4/ was employed to identify the plane and direction of a crack surface in relation to product geometry. This identification is designated by a hyphenated code with the first letter representing the direction normal to the crack plane and the second letter designating the expected direction of crack propagation. The nomenclature for a pipe geometry as shown in Figure 1 is as follows: C = circumferential, L = longitudinal an R = radial.

In the stability assessment of through circumferential and longitudinal cracks, J-Resistance curves in the L-C and C-L crack plane orientations, respectively, are required. Specimens from SA106B and SA105 forgings were machined from both L-C and C-L orientation. Since the welds are circumferential, the weld samples and the heat affected zone samples could only be machined in the L-C orientation.

A study of toughness anisotropy of SA106B pipe/5/ has shown that the toughness in the L-C orientation is lower than that in the L-R orientation and that toughness in the C-L direction is lower than that in the C-R direction. For these reasons, fracture properties only in the L-C and C-L orientations were tested. If required, fracture properties in the L-C and C-L directions could be conservatively used for L-R and C-R properties, respectively. Also note that compact tension specimens cannot be cut in the L-R and C-R directions from these relatively thin pipes.

2.4 Test Temperature

It has been recommended in NUREG-1061, Volume 3, "Evaluation of Potential Pipe Breaks"/6/ that J-resistance tests should be conducted at a temperature near the upper range of normal plant operation. The maximum normal operating temperature of the heat transport system occurs in the reactor outlet header and is 310°C. It is known that ductility of SA106B steel, as measured by the lateral contraction during a tensile test, shows a minimum value between 200°C and 300°C. Tensile tests were conducted in this temperature range and it was established that the lateral contraction of this material is minimum in the neighbourhood of 250°C/7/. Single specimen J_{IC} tests were conducted at 200°C, 250°C and

300°C to confirm that the toughness of the material, when characterized by J_{IC} and R-curve, also goes through a minimum near 250°C. Therefore, 250°C was selected as the appropriate test temperature to measure conservatively the material response at 310°C. In order to determine if there is any significant dependence of toughness on temperature over the temperature range, a temperature of 20° was selected, as a conservative lower bound of the lowest service temperature for the heat transport system.

Since the metallurgical composition of SA106B is similar to SA105, temperature dependence tests were conducted using only SA106B material.

2.5 Welding Considerations

Various welding procedures have been developed by Ontario Hydro to satisfy ASME code requirements. Pipe size, type of welding, shop or field weld, class of pipe, wall thickness, etc. are taken into consideration. Two welding procedures that do not require post weld heat treatment (PWHT) (PN-107 and PN-229) were used for girth-butt welds on 12" and 22" NPS pipes. Two different welding procedures that require PWHT (PN-108 and PN-232) were used for the 24" pipe. Each of these welding procedures for nuclear Class I piping were included in the test program. These welding procedures are listed in Table 2.

Manual stick welds (PN-107 and PN-108) have slight variation in properties that vary around the circumference of the pipe. The variation is most noticeable at the 6 o'clock position, due to the difficulty of welding a pipe at this position. To ensure conservative results, test specimens were machined from blocks that were taken from the 6 o'clock position.

Tests were conducted on the weld material and the heat affected zone (HAZ) material. The orientation of the crack in the weld material was in the L-C orientation. A difficulty in performing HAZ tests is that the HAZ is very thin and is parallel to the V-notch of the weld preparation surfaces. Thus the HAZ is not oriented in the circumferential (L-C) or the axial (C-L) direction of the pipe. Taking this into account, HAZ specimens were machined as shown in Figure 2. The (L-C) specimen orientation was maintained and the crack front straddled the HAZ, parent and weld material. The measured HAZ toughness is therefore an average toughness. The HAZs on both sides of the weld were tested when different heats were welded together.

2.6 Post-Weld Heat Treatment

Post weld heat treatment is often applied to relax residual stresses caused by the welding process and to temper the heat affected zone. For high toughness material, residual stresses will influence processes that are controlled by the elastic loading conditions. Residual stresses have no effect on the applied load at which ductile failure occurs.

The ASME Code/8/ Table NB-4622.7(b)-1 requires post weld heat treatment (PWHT) for welds to pipes with nominal wall thickness greater than 38 mm (1.5 inches). Therefore the only large diameter HT piping that did not require post weld heat treatment at Darlington NGS was the 22 NPS pipe. In order to assess the effect of post-weld heat treatment on the J-R curves, 22" NPS girth-butt welds were tested with post-weld heat treatment (22" NPS with PN-108 weld procedures) and without post-weld heat treatment (22" NPS with PN-107 weld procedure). The PN-229 weld procedure applied to the 22" NPS pipe was also tested with and without post-weld heat treatment. All welds within the scope of the DLBB project (Units 1 and 2) were subject to suitable post weld heat treatment.

The entire test matrix is shown in Table III. Altogether 91 tests were conducted in this test program.

3.0 TEST METHOD

The ASTM test procedure E813 Test for J_{IC}, a Measure of Fracture Toughness/1/ and a proposed ASTM method, Standard Test Method for Determining J-R curves/2/ were used in this test program. Three different sizes of compact tension (CT) specimens, 1-1/4", 1" and 3/4" thicknesses were used. The sizes of the specimens were determined by the largest CT specimens that could be machined from the 24", 22" and 12" NPS pipe, respectively. Material cutting diagrams are located in Appendix A. Specimen dimensions are shown in Figure 3. A 250 kN capacity MTS servohydraulic machine was used to conduct the tests. A clevis and pin arrangement was used to grip the CT specimens. The displacement transducer was calibrated at room temperature and 300°C. The load cell was calibrated by the manufactures of the testing machine prior to the test program.

All specimens were precracked as per the ASTM specification and sidegrooved after precracking to promote flat fracture and a straight crack front. In some cases the crack front may exhibit severe tunneling with no side grooves. It has been shown that a 20% side grooving will eliminate tunneling in CT specimens. Sidegrooving increases the amount of crack tip constraint and produces a conservative value of crack initiation toughness (J_{IC}) and resistance curve. The average thickness reduction due to side grooving was approximately 20%.

J-R curves were determined by the single specimen technique. Crack length and crack extension were determined from elastic compliance measurements. These measurements were taken on a series of unloading/reloading segments spaced along the load-versus load line displacement record. The unload/reload segments are conducted under elastic conditions, even though the specimen may have undergone extensive plastic deformation. The change in crack length from one unloading to the next can be inferred through a change in the normalized compliance ($EB\delta/P$) where E is Young's Modulus, B is the specimen thickness and P and δ are load and load line deflection, respectively. J values are calculated at the end of the test from the area under the load vs load line deflection curves using the equations in Section 3.1. The displacement rates during the tests were between 1/2 to 1 mm/minute.

The area of the slow stable crack extension at the end of the room temperature test was highlighted by heat tinting. Note that the area of stable crack extension tested at 250°C became tinted automatically during the test. Following heat tinting, the specimens were chilled in liquid nitrogen and broken in two to expose the crack surfaces. The initial crack size after precracking and the heat tinted crack front were measured on the fracture surface using a nine point average method as per the ASTM specification.

3.1 Calculations

Since the ASTM test procedure/1,2/ was followed in the test program, the formulae used in calculating J and crack length are reproduced in the following section from the ASTM specification.

3.1.1 Crack Length Calculation:

For C(T) specimens, the crack length a_i at the unloading point i is given by /9/:

$$a_i/W = 1.00196 - 4.06319u_{LL} + 11.242u_{LL}^2 - 106.043u_{LL}^3 + 464.335u_{LL}^4 - 650.677u_{LL}^5 \qquad (1)$$

where,

$$u_{LL} = \frac{1}{\left[B_e E C_i\right]^{1/2} + 1}$$

E = modulus of elasticity

$B_e = B - (B-B_N)^2/B$ = effective specimen thickness

C_i = the specimen elastic compliance on the unloading/reloading sequence ($\Delta\delta/\Delta P$) at point i

W = specimen width

B = specimen thickness

B_N = net specimen thickness after side grooving

To account for crack opening displacement in CT specimens the crack size estimations should be corrected for rotation/10/.

Compliance should be corrected according to:

$$C_c = \frac{C_m}{\left[\frac{H^*}{R}\sin\theta - \cos\theta\right]\left[\frac{D}{R}\sin\theta - \cos\theta\right]}$$

where (Figure 4),

C_m = measured specimen elastic compliance (at the load line)

H^* = initial half span of the load points (centre of pin holes)

R = radius of rotation of the crack centreline, $(W+a)/2$ where a is the updated crack length

D = one-half of the initial distance between the displacement measurement points

θ = angle of rotation of a rigid body element about the unbroken midsection line

$$\theta = \sin^{-1}\left[(d_m/2 + D)/(D^2 + R^2)^{1/2}\right] - \tan^{-1}(D/R)$$

d_m = total measured load line displacement

C_c = specimen elastic compliance, corrected for rotation of the specimen

3.1.2 J Calculation:

The J value can be calculated at any point on the load versus load-line displacement record using the relationship:

$$J = J_{el} + J_{Pl} \qquad (2)$$

where J_{el} is the elastic component of J, and J_{pl} is the plastic component of J.

For the compact specimen at a point corresponding to the coordinates P_i, and δ_i on the specimen load versus load line displacement record, and a_i (which equals $a_o + \Delta a_{pi}$):

$$J_{(i)} = \frac{(K_{(i)})^2(1-\nu^2)}{E} + J_{pl}(i) \qquad (3)$$

where from ASTM method E399/4/:

$$K_{(i)} = \left[P_i/(BB_NW)^{1/2}\right] \cdot f(a_i/W) \qquad (4)$$

with:

$$f(a_i/W) = \frac{(2+a_i/W)(0.886+4.64a_i/W-13.32(a_i/W)^2 + 14.72(a_i/W)^3-5.6(a_i/W)^4)}{(1-a_i/W)^{3/2}}$$

and:

$$J_{pl(i)} = \left[J_{pl(i-1)} + \left(\frac{\eta_i}{b_i}\right)\frac{A_{pl(i)} - A_{pl(i-1)}}{B_N}\right]\left[1 - \gamma_i\,\frac{(a_i - a_{i-1})}{b_i}\right] \qquad (5)$$

where:

$\eta_i = 2.0 + 0.522\ b_i/W$

$\gamma_i = 1.0 + 0.76\ b_i/W$

a_o = initial crack length after precracking

a_{pi} = physical crack extension at point i

ν = Poisson's ratio

b_i = remaining ligament at point i

In the above equation the quantity $A_{pl(i)}-A_{pl(i-1)}$ is the increment of plastic area under the load versus load line displacement record between lines of constant displacement at points i-1 and i. The quantity $J_{pl(i)}$ represents the total crack-growth-corrected plastic J at point i and is obtained in two steps by first incrementing the existing $J_{pl(i-1)}$ and then by modifying the total accumulated result to account for the crack growth increment. The quantity $A_{pl(i)}$ can be calculated from the equation:

$$A_{pl(i)} - A_{pl(i-1)} = [P_i + P_{i-1}]\,[\delta_{pli} - \delta_{pli-1}]/2$$

where:

δ_{pli} = plastic part of the load-line displacement

$= \delta_i - (P_i C_i)$

C_i = compliance $(\Delta\delta / \Delta P)_i$ required to give the current crack length, a_i.

All compliance values were corrected for rotational correction using the method indicated in the Section 3.1.1.

3.1.3 Calculation of Modified Version of J Called J_M

For cases where the calculated J and/or crack growth exceed the measurement capacity outlined in the ASTM specification/2/, a modified version of J called J_M has been formulated/11/.

J_M is calculated from the following incremental equation

$$J_{M(i)} = J_{D(i)} + J_{(i)} \qquad (6)$$

Where $J_{D(i)}$ represents the value of the deformation theory J at that level and $J_{(i)}$ is given by:

$$\Delta J_{(i)} = \Delta J_{(i-1)} + \left(\frac{\gamma}{b} \cdot J_{pl}\right)_{i-1} (a_i - a_{i-1})$$

where $J_{(i)} = 0$ for $i = 0$.

In particular for the CT specimens:

$$\gamma_i = 1.0 + 0.76 \cdot b_i/W$$

The $J_{D(i)}$ value at any point on the load versus load line displacement record can be calculated using the following relationship/12/:

$$J_{D(i)} = \left[J_{D(i-1)} + \left(\frac{\eta_{i-1}}{b_{i-1}}\right)\frac{A_i - A_{i-1}}{B_N}\right]\left[1 - \gamma_{i-1}\frac{(a_i - a_{i-1})}{b_{i-1}}\right]$$

Where η is a function given in Section 3.1.2.

A personal computer was used for test control and data acquisition/3/. A computer program was developed to control the loading and unloading sequence and to insert a one minute hold time before each unloading to minimize any effect of stress relaxation on the slope of the unloading line. A separate computer program was used to analyze the acquired data, print out a data sheet and the analyzed data and finally to scale and plot the experimental results on a plotter.

4.0 DATA SHEET DESCRIPTION AND INTERPRETATION OF RESULTS

The total test matrix is shown in Table III. There are 85 tests in the J series and 6 tests in the TD series. The TD (temperature dependence) series of tests were conducted to confirm that within the temperature range of 200°C to 300°, the J_{Ic} values are minimum near 250°C. The J series of tests were conducted to establish the material data base at 20°C and 250°C. For each specimen tested there is one data sheet, 4 tables and 3 graphs. For archival purpose, all data sheets, tables and graphs from all 91 tests are included in this report in Appendix D.

The following information is included in the data sheet (Table IV).

Test Specimen Data

Fatigue Precracking Data

Crack Length Measurement

Analysis of Least Square Linear Line (for J_{IC} Calculation)

Validity of J_{IC}

Qualification of R-Curve Data

Curve Fit (to the R Curve)

The data contained in the data sheet are self explanatory. However, a few items which may need further explanations are given below. Items enclosed in quotes refer to labels on data sheet.

Test Specimen Data

'Material Yield Strength at Test Temperature':

'Material Tensile Strength at Test Temperature':

These values were obtained from a tensile test program/7/. The effective yield value σ_y used in this analysis is defined as the average of the yield strength (0.2% offset stress) and the ultimate tensile strength values.

'Young's Modulus at Test Temperature':

This value was taken from the ASME Boiler and Pressure Vessel Code/8/ for SA106B steel at the appropriate temperature and was used in all calculations.

'Effective Modulus':

This value was calculated from the first compliance reading taken during the J-R curve test and the measured original crack size (average fatigue length 9 pt on the data sheet). The Young's modulus should be within ±10% of the effective modulus. The effective modulus was not used in any calculation but it was determined to provide an additional check on the data.

Crack Length Measurement

'Average Fatigue Length 9 Pt':

'Average Crack Extension 9 Pt':

These are the measured values of the initial crack length after precracking and the ductile crack extension respectively. These were measured on the fracture surface after the test using a 9 point averaging technique.

'Delta A (cm) Compliance':

Ductile crack extension calculated from compliance measurement.

'Maximum Deviation of Single Measurement (%)':

This is a measure of the straightness of the original crack front. In order to meet the ASTM standard any of the nine physical measurements should be within 7% of the 9 point average. In our opinion, useful information is obtained, even if this ASTM requirement is violated.

Analysis - Least Square Linear Line (ASTM):

To establish a crack initiation measurement point under slow-stable crack growth, a linear extrapolation procedure was used. J-integral values were plotted against the corresponding measured crack extension values (Δa) as shown in Figure 5. The blunting line was drawn on this figure according to the following equation:

$$J = 2\sigma_y \Delta a$$

where: σ_y = effective yield

= (yield strength + ultimate tensile strength)/2

Two lines were drawn on the same figure which were parallel to the blunting line but were offset by 0.15 and 1.5 mm, respectively. Using a method of least squares, a linear regression line of J upon Δa was determined using the points that fall within two parallel offset lines. The J value at the intersection of this linear regression line with the blunting line is J_{IC} if certain validity conditions are met.

'First Point':

'Last Point':

These indicate the points within the data set that lie within the parallel offset lines and were used to determine the linear regression line.

'J_{IC}':

J at the intersection of the linear regression line with the blunting line.

'Correlation Coefficient':

Correlation coefficient of the linear regression line.

'Slope':

Slope of the linear regression line. It can be used to calculate average tearing modulus at J_{IC}.

'Intercept':

Intersection of linear regression line with the Y axis where $\Delta a = 0$.

Validity (J_{IC} (According to ASTM Standard/1/):

J at the intersection of the linear regression line with the blunting line is J_{IC} provided the following conditions are met:

(1) B (net) < 25 J_{IC}/Effective Yield

(2) Initial ligament b > 25 J_{IC}/Effective Yield

(3) The slope of the regression line dJ/da < Effective Yield.

The section of the data sheet indicates whether or not these conditions are met.

Qualification of R-Curve Data (According to a proposed ASTM Standard/2/)

'Crack Extension Validity':

This is an indication of the straightness of a crack front after ductile crack extension. If the measured crack extension, Δa_p, at either of the two near-surface points differ from the crack extension at the centre by more than $\pm 0.02W$ then the condition of straightness is not met. In this test program some of the weld samples did not meet this condition due to uneven crack extension through the weld metal. In our opinion, useful information is obtained, even if this ASTM requirement is violated.

'Crack Size':

This is an indication of the agreement between the measured physical crack extension Δa_p and calculated crack extension Δa. The difference between these values should not exceed 0.15 Δa_p. All but 4 tests met this validity criteria. Figures 8 and 9 show the comparison between the measured and calculated initial crack length and crack extension for all tests.

'J (Max) Allowed':

'Delta A (Max) Allowed':

These indicate the maximum measurement capacity of each specimen. The maximum J-integral capacity for a specimen is given by the smaller of:

$$J_{max} = (b \times \text{Effective Yield})/20$$

or

$$J_{max} = (B(net) \times \text{Effective Yield})/20$$

The maximum crack extension capacity for a specimen is given by:

$$\Delta a_{max} = 0.1\ b_o$$

where b_o is the remaining ligament at the start of a test.

In our opinion, useful information is obtained, even if these limits are exceeded.

Curve Fit:

A J-R curve is established by fitting a curve through experimental data points. A power law equation of the form:

$$J = C_1 (\Delta a)^{C_2}$$

was used for this purpose.

'1st Data Point Used':

'Last Data Point Used':

These identify the range of experimental data that were used to calculate the constant C_1 and the exponent C_2. The first data point was normally selected just beyond J_{IC}. The last data point was selected to provide a smooth visual fit through the experimental points beyond J_{IC}. The values of C_1 and C_2 are shown on the data sheet where J is in kN/m and a is in mm. The power law regression line is shown in Figure 5.

4.1 Data Tables

For each specimen tested there are 4 tables.

(1) Table of Various J Values (Table V);

(2) J-Δa Table (Table VI);

(3) Load vs. Load Line Displacement Table (Table VII);

(4) J-T-ω Table (Table VIII).

Each table is identified by a specimen number.

Table of various J values (Table V)

Column 1 – Stress intensity factor K in MPa $\sqrt{m}$ calculated by using Equation 4.

Column 2 – J-elastic (J_{el}) in kN/m, first term of Equation 3.

Column 3 – J-plastic (J_{pl}) in kN/m, from Equation 5.

Column 4 – $J = J_{el} + J_{pl}$ from Equation 3.

Column 5 – J-modified J_M in kN/m from Equation 6.

Column 6 – J(TO AREA), Deformation theory J from Equation 7.

Column 7 – Crack length in cm at each unloading point, corrected for rotational correction.

Column 8 – Sequence of unloading points.

Table of J–Δa (Table VI)

Column 1 – $J = J_{el} + J_{pl}$ from Equation 3.

Column 2 – Uncorrected crack length in cm at each unloading point.

Column 3 – Crack length in cm at each unloading point, corrected for rotational correction.

Column 4 – Stable–ductile crack extension in mm at each unloading point.

Column 5 – Correlation coefficient of a least squares line drawn through data points taken during the unloading part of the unloading–reloading sequence. Compliance values were calculated from the slope of this curve.

Column 6 – Sequence of unloading points.

Table of Load vs Load Line Displacement (Table VII)

Column 1 – Starting point and the sequence of unloading points.

Column 2 – Load values in kN.

Column 3 – Load line displacement values in mm.

Table of J–T–ω (Table VIII)

Column 1 – Sequence of readings.

Column 2 – J values after J_{IC} in kN/m.

Column 3 – Tearing modulus corresponding to the J values. T is a dimensionless quantity determined from:

$$T = \frac{E}{\sigma_y^2} \cdot \frac{dJ}{da}$$

Column 4 – ω values corresponding to the J values. ω is a dimensionless quantity determined from:

$$\omega = \frac{dJ}{da} \cdot \frac{b}{J}$$

Where b is the remaining ligament. the condition for the proportional loading (J-controlled growth) is expressed as:

$$\omega = \frac{dJ}{da} \cdot \frac{b}{J} \gg 1$$

5.0 GRAPHS

For each specimen tested, there are 3 graphs. All graphs were drawn using the same scale so that they can be readily compared.

(1) J-R Curve (Figure 5).

(2) Load vs Load Line Displacement Curve (Figure 6).

(3) J-T Curve (Figure 7).

J-R Curve (Figure 5)

This is a plot of J-integral, as per ASTM specification/2/ ($J = J_{el} + J_{pl}$), versus crack extension. All experimental points are shown on this graph. It also shows the blunting line, 0.15 mm and 1.5 mm offset lines and the least squares line drawn through the experimental points between the offset lines. It also shows the power law regression fit drawn by using $J = C_1 (\Delta a)^{C_2}$ relationship. The points used in estimating the constants C_1 and C_2 are identified in the data sheet. The legends in the corner of the graph identifies the specimen number and test temperature, slope of the least squares line in MPa, intercept of the least squares line with the Y-axis in kN/m and the J_{IC} value in kN/m.

Load vs Load Line Displacement Curve (Figure 6)

These are experimental data points taken at the beginning of each unloading-reloading cycle.

J-T Curve (Figure 7)

This is a J-integral versus tearing modulus curve derived from the J-R curve. Noting that:

$$T = \frac{E}{\sigma_y^2} \cdot \frac{dJ}{da}$$

and that a J-R curve can be expressed by

$$J = C_1 (\Delta a)^{C_2}$$

A simple differentiation will show

$$J = C_1 \left[\frac{T \sigma_y^2}{E C_1 C_2} \right]^{\frac{C_2}{C_2 - 1}}$$

This expression is plotted in a J–T domain beginning approximately at J_{IC} and terminating at the maximum value of J reached during the test. This could be above J_{max} limits given in Section 4.

6.0 PRESENTATION OF RESULTS

For archival purpose, all test results are documented in Appendices B, C and D.

Appendix B is a summary table of all test results.

Appendix C shows fracture surfaces of all tests in numerical sequence.

Appendix D contains test results and graphs from the J series and the TD series of tests in numerical sequence. For each specimen tested, there is one data sheet, four tables and three graphs.

The entire data set is stored in a data base in the Mechanical Design Department's VAX computer for quick access and for application to the Darlington LBB project.

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TABLE I

Large Diameter Piping Heats Darlington NGS A Heat Transport Piping Units 1 and 2

Pipe Size (NPS)	Heat Numbers
21	J1136
	J1157
	J9980
22	J9968
	J9969
	L7204
24	J1136
	J1157
	J9980
	J9982
	L7204
	L7205

TABLE II

Ontario Hydro Nuclear Weld Procedures

NPS (Inches)	Ontario Hydro Weld Procedure	Weld Process
12 22	PN-107	- GTAW root pass - SMAW fill up - field and shop welding - no PWHT
	PN-229	- GTAW root pass - SAW fill up - For shop welding only - No PWHT
24	PN-108	- GTAW root pass - SMAW fill up - For field and shop welding - PWHT performed
	PN-232	- GTAW root pass - SAW fill up - For shop welding only - PHWT performed

Notes: (1) PN-108 weld procedure applied to 22" NPS pipe also for comparison of effect of PWHT.

TABLE III DARLINGTON LBB J-RESISTANCE CURVES

DARLINGTON LBB MATERIAL DATA SUMMARY TABLE

	TEST NO	MATERIAL	DIRECTION OF TEST	COUPON NO	DESCRIPTION	TEST TEMP C	DATE	YIELD STRESS MPa	ULTIMATE STRESS MPa	THICKNESS B cm	SIDE GROOVE %	Bn cm	WIDTH W cm	YOUNGS MODULUS Pa
J	1	PARENT	L-C	M1	24" NPS Sch 100	250	23-May-86	228.0	510.8	3.175	19.8	2.547	6.365	1.828E+11
J	2	PARENT	L-C	M1	24" NPS Sch 100	250	17-Sep-85	228.0	510.8	3.174	19.8	2.547	6.361	1.828E+11
J	3	PARENT	L-C	S1	24" NPS Sch 100	250	18-Sep-85	228.0	510.8	3.175	19.6	2.552	6.364	1.828E+11
J	4	WELD PN-108	L-C	A1	24" NPS Sch 100	250	20-Sep-85	275.3	482.0	3.047	21.2	2.400	6.360	1.828E+11
J	5	WELD PN-108	L-C	A1	24" NPS Sch 100	250	19-Sep-85	275.3	482.0	3.046	21.2	2.400	6.365	1.828E+11
J	6	WELD PN-108	L-C	A3	24" NPS Sch 100	250	23-Sep-85	275.3	482.0	3.048	21.0	2.409	6.361	1.828E+11
J	7	HAZ PN-108	L-C	A2	24" NPS Sch 100	250	21-Jan-86	275.3	482.0	3.053	21.4	2.400	6.360	1.828E+11
J	8	HAZ PN-108	L-C	A2	24" NPS Sch 100	250	20-Jan-86	275.3	482.0	2.901	21.3	2.284	6.297	1.828E+11
J	9	WELD PN-232	L-C	B1	24" NPS Sch 100	250	24-Sep-85	249.3	423.4	3.047	21.1	2.403	6.359	1.828E+11
J	10	WELD PN-232	L-C	B1	24" NPS Sch 100	250	25-Sep-85	249.3	423.4	3.046	20.9	2.410	6.361	1.828E+11
J	11	WELD PN-232	L-C	B3	24" NPS Sch 100	250	26-Sep-85	249.3	423.4	3.051	21.4	2.398	6.360	1.828E+11
J	12	HAZ PN-232	L-C	B2	24" NPS Sch 100	250	23-Jan-86	249.3	423.4	3.040	20.5	2.418	6.351	1.828E+11
J	13	HAZ PN-232	L-C	B2	24" NPS Sch 100	250	22-Jan-86	249.3	423.4	3.055	20.3	2.434	6.300	1.828E+11
J	14	PARENT	L-C	N1	22" NPS Sch 100	20	26-Nov-85	320.3	532.6	3.048	19.4	2.458	6.349	1.923E+11
J	15	PARENT	L-C	N1	22" NPS Sch 100	20	25-Nov-85	320.3	532.6	3.050	19.3	2.461	6.349	1.923E+11
J	16	PARENT	L-C	N2	22" NPS Sch 100	20	29-Nov-85	320.3	532.6	3.050	19.3	2.461	6.349	1.923E+11
J	17	PARENT	L-C	N1	22" NPS Sch 100	250	28-Nov-85	220.7	508.5	3.049	19.3	2.460	6.347	1.828E+11
J	18	PARENT	L-C	N2	22" NPS Sch 100	250	28-Nov-85	220.7	508.5	3.049	19.4	2.459	6.344	1.828E+11
J	19	PARENT	L-C	N2	22" NPS Sch 100	250	27-Nov-85	220.7	508.5	3.049	19.5	2.455	6.345	1.828E+11
J	20	WELD PN-107	L-C	C1	22" NPS Sch 100	20	23-Oct-85	347.7	547.2	2.541	20.1	2.030	5.095	1.923E+11
J	21	WELD PN-107	L-C	C1	22" NPS Sch 100	20	24-Oct-85	347.7	547.2	2.542	21.5	1.995	5.090	1.923E+11
J	22	WELD PN-107	L-C	C2	22" NPS Sch 100	20	25-Oct-85	347.7	547.2	2.540	20.9	2.008	5.093	1.923E+11
J	23	WELD PN-107	L-C	C4	22" NPS Sch 100	250	18-Oct-85	353.7	542.3	2.540	20.8	2.012	5.092	1.828E+11
J	24	WELD PN-107	L-C	C2	22" NPS Sch 100	250	21-Oct-85	353.7	542.3	2.541	20.7	2.015	5.091	1.828E+11
J	25	WELD PN-107	L-C	C4	22" NPS Sch 100	250	22-Oct-85	353.7	542.3	2.540	20.5	2.020	5.090	1.828E+11
J	26	HAZ PN-107	L-C	C3	22" NPS Sch 100	20	03-Dec-85	347.7	547.2	2.537	21.0	2.005	5.082	1.923E+11
J	27	HAZ PN-107	L-C	C3	22" NPS Sch 100	20	04-Dec-85	347.7	547.2	2.540	20.6	2.017	5.082	1.923E+11
J	28	HAZ PN-107	L-C	C6	22" NPS Sch 100	250	14-Nov-85	353.7	542.3	2.538	21.0	2.006	5.084	1.828E+11
J	29	HAZ PN-107	L-C	C6	22" NPS Sch 100	250	13-Nov-85	353.7	542.3	2.540	21.0	2.007	5.084	1.828E+11
J	30	WELD PN-229	L-C	D1	22" NPS Sch 100	20	28-Oct-85	367.0	516.1	2.540	20.8	2.011	5.095	1.923E+11
J	31	WELD PN-229	L-C	D1	22" NPS Sch 100	20	29-Oct-85	367.0	516.1	2.540	20.5	2.019	5.091	1.923E+11
J	32	WELD PN-229	L-C	D2	22" NPS Sch 100	20	30-Oct-85	367.0	516.1	2.540	20.8	2.012	5.095	1.923E+11
J	33	WELD PN-229	L-C	D4	22" NPS Sch 100	250	27-Sep-85	364.0	553.1	2.540	20.7	2.014	5.093	1.828E+11
J	34	WELD PN-229	L-C	D2	22" NPS Sch 100	250	30-Sep-85	364.0	553.1	2.540	20.5	2.020	5.091	1.828E+11
J	35	WELD PN-229	L-C	D4	22" NPS Sch 100	250	01-Oct-85	364.0	553.1	2.541	20.4	2.022	5.093	1.828E+11
J	36	HAZ PN-229	L-C	D3	22" NPS Sch 100	20	11-Nov-85	367.0	516.1	2.540	21.1	2.003	5.084	1.923E+11
J	37	HAZ PN-229	L-C	D3	22" NPS Sch 100	20	12-Nov-85	367.0	516.1	2.540	21.4	1.996	5.083	1.923E+11
J	38	HAZ PN-229	L-C	D6	22" NPS Sch 100	250	08-Nov-85	364.0	553.7	2.539	21.4	1.996	5.082	1.828E+11
J	39	HAZ PN-229	L-C	D6	22" NPS Sch 100	250	07-Nov-85	364.0	553.7	2.540	20.9	2.009	5.085	1.828E+11
J	40	WELD PN-108	L-C	E1	22" NPS Sch 100	250	02-Oct-85	273.0	479.8	2.538	21.1	2.002	5.091	1.828E+11
J	41	WELD PN-108	L-C	E1	22" NPS Sch 100	250	03-Oct-85	273.0	479.8	2.544	21.2	2.004	5.091	1.828E+11
J	42	WELD PN-108	L-C	E2	22" NPS Sch 100	250	04-Oct-85	273.0	479.8	2.540	21.2	2.001	5.093	1.828E+11
J	43	HAZ PN-108	L-C	E2	22" NPS Sch 100	250	05-Nov-85	273.0	479.8	2.540	21.2	2.002	5.083	1.828E+11
J	44	HAZ PN-108	L-C	E2	22" NPS Sch 100	250	06-Nov-85	273.0	479.8	2.539	20.3	2.024	5.082	1.828E+11
J	45	PARENT	L-C	P1	12" NPS Sch100	250	17-Jan-86	267.3	559.3	1.908	20.3	1.521	3.810	1.828E+11
J	46	PARENT	L-C	P1	12" NPS Sch100	250	16-Jan-86	267.3	559.3	1.906	21.0	1.505	3.809	1.828E+11

DARLINGTON LBB MATERIAL DATA SUMMARY TABLE

	TEST NO	MATERIAL	DIRECTION OF TEST	COUPON NO	DESCRIPTION	TEST TEMP C	DATE	YIELD STRESS MPa	ULTIMATE STRESS MPa	THICKNESS B cm	SIDE GROOVE %	Bn cm	WIDTH W cm	YOUNGS MODULUS Pa
J	47	PARENT	L-C	P2	12" NPS Sch100	250	15-Jan-86	267.3	559.3	1.905	20.2	1.520	3.809	1.828E+11
J	48	WELD PN-107	L-C	F1	12" NPS Sch100	250	14-Jan-86	324.0	548.2	1.589	20.8	1.259	3.810	1.828E+11
J	49	WELD PN-107	L-C	F1	12" NPS Sch100	250	13-Jan-86	324.0	548.2	1.637	20.4	1.303	3.809	1.828E+11
J	50	WELD PN-107	L-C	F2	12" NPS Sch100	250	09-Jan-86	324.0	548.2	1.637	19.3	1.321	3.808	1.828E+11
J	51	HAZ PN-107	L-C	F3	12" NPS Sch100	250	08-Jan-86	324.0	548.2	1.637	18.6	1.333	3.804	1.828E+11
J	52	HAZ PN-107	L-C	F3	12" NPS Sch100	250	07-Jan-86	324.0	548.2	1.637	18.9	1.328	3.813	1.828E+11
J	53	PARENT	L-C	R1	22"*12" VESSELET	20	29-Nov-85	322.7	560.6	2.540	21.1	2.005	5.079	1.923E+11
J	54	PARENT	L-C	R1	22"*12" VESSELET	20	02-Dec-85	322.7	560.6	2.540	21.6	1.991	5.083	1.923E+11
J	55	PARENT	L-C	R2	22"*12" VESSELET	20	02-Dec-85	322.7	560.6	2.541	21.2	2.003	5.084	1.923E+11
J	56	PARENT	L-C	R1	22"*12" VESSELET	250	28-Oct-85	231.0	528.8	2.540	20.8	2.012	5.083	1.828E+11
J	57	PARENT	L-C	R2	22"*12" VESSELET	250	30-Oct-85	231.0	528.8	2.542	21.5	1.995	5.080	1.828E+11
J	58	PARENT	L-C	R2	22"*12" VESSELET	250	31-Oct-85	231.0	528.8	2.540	21.1	2.005	5.081	1.828E+11
J	59	PARENT	C-L	M2	24" NPS Sch 100	250	07-Oct-85	268.3	525.5	3.180	20.0	2.544	6.362	1.828E+11
J	60	PARENT	C-L	M2	24" NPS Sch 100	250	08-Oct-85	268.3	525.5	3.177	20.0	2.541	6.365	1.828E+11
J	61	PARENT	C-L	S1	24" NPS Sch 100	250	09-Oct-85	268.3	525.5	3.175	19.7	2.551	6.366	1.828E+11
J	62	PARENT	C-L	N3	22" NPS Sch 100	20	10-Oct-85	324.0	529.5	3.160	19.0	2.560	6.370	1.923E+11
J	63	PARENT	C-L	N3	22" NPS Sch 100	20	11-Oct-85	324.0	529.5	3.150	18.2	2.576	6.360	1.923E+11
J	64	PARENT	C-L	N4	22" NPS Sch 100	20	15-Oct-85	324.0	529.5	3.175	19.5	2.555	6.360	1.923E+11
J	65	PARENT	C-L	N3	22" NPS Sch 100	250	16-Oct-85	224.0	506.1	3.160	18.9	2.563	6.360	1.828E+11
J	66	PARENT	C-L	N4	22" NPS Sch 100	250	16-Oct-85	224.0	506.1	3.176	19.8	2.546	6.358	1.828E+11
J	67	PARENT	C-L	N4	22" NPS Sch 100	250	17-Oct-85	224.0	506.1	3.177	20.1	2.540	6.367	1.828E+11
J	68	PARENT	C-L	P2	12" NPS Sch100	250	06-Jan-86	218.0	554.9	1.905	20.4	1.517	3.807	1.828E+11
J	69	PARENT	C-L	P3	12" NPS Sch100	250	03-Jan-86	218.0	554.9	1.906	20.6	1.513	3.812	1.828E+11
J	70	PARENT	C-L	P3	12" NPS Sch100	250	02-Jan-86	218.0	554.9	1.906	20.7	1.511	3.808	1.828E+11
J	71	PARENT	C-L	R3	22"*12" VESSELET	20	01-Nov-85	311.0	561.7	2.540	20.9	2.009	5.083	1.923E+11
J	72	PARENT	C-L	R3	22"*12" VESSELET	20	03-Nov-85	311.0	561.7	2.540	21.1	2.004	5.079	1.923E+11
J	73	PARENT	C-L	R4	22"*12" VESSELET	20	02-Nov-85	311.0	561.7	2.540	21.2	2.001	5.077	1.923E+11
J	74	PARENT	C-L	R3	22"*12" VESSELET	20	02-Nov-85	311.0	561.7	2.542	21.9	1.986	5.079	1.923E+11
J	75	PARENT	C-L	R4	22"*12" VESSELET	20	03-Nov-85	311.0	561.7	2.540	21.1	2.004	5.084	1.923E+11
J	76	PARENT	C-L	R4	22"*12" VESSELET	20	04-Nov-85	311.0	561.7	2.540	21.1	2.004	5.085	1.923E+11
J	77	PARENT	C-L	R5	22"*12" VESSELET	250	14-Apr-86	228.3	526.4	2.541	20.0	2.032	5.081	1.828E+11
J	78	PARENT	C-L	R5	22"*12" VESSELET	250	10-Apr-86	228.3	526.4	2.540	19.9	2.034	5.093	1.828E+11
J	79	PARENT	C-L	F6	22"*12" VESSELET	250	11-Apr-86	228.3	526.4	2.541	19.7	2.042	5.079	1.828E+11
J	80	WELD PN-232	L-C	B3	24" NPS Sch 100	20	07-Apr-86	309.0	512.0	2.539	20.2	2.026	5.082	1.923E+11
J	81	WELD PN-232	L-C	B8	24" NPS Sch 100	20	08-Apr-86	309.0	512.0	3.032	20.9	2.397	6.352	1.923E+11
J	82	WELD PN-232	L-C	B8	24" NPS Sch 100	20	09-Apr-86	309.0	512.0	2.541	20.3	2.024	5.081	1.923E+11
J	83	W PN229 SR	L-C	D5	22" NPS Sch 100	20	24-Feb-86	367.0	516.0	2.541	21.6	1.991	5.089	1.923E+11
J	84	W PN229 SR	L-C	D5	22" NPS Sch 100	250	25-Feb-86	364.0	553.1	2.539	21.1	2.003	5.090	1.828E+11
J	85	W PN229 SR	L-C	D8	22" NPS Sch 100	250	26-Feb-86	364.0	553.1	2.540	21.2	2.001	5.087	1.828E+11
TD	13	PARENT	C-L	M5	24" NPS Sch 100	200	15-Sep-85	248.5	482.0	3.177	20.3	2.531	6.365	1.864E+11
TD	14	PARENT	C-L	M5	24" NPS Sch 100	200	14-Sep-85	248.5	482.0	3.174	19.9	2.543	6.363	1.864E+11
TD	15	PARENT	C-L	M5	24" NPS Sch 100	250	13-Sep-85	228.0	510.8	3.175	19.7	2.551	6.360	1.828E+11
TD	16	PARENT	C-L	M2	24" NPS Sch 100	300	28-May-86	223.0	513.8	3.174	19.6	2.552	6.366	1.785E+11
TD	17	PARENT	C-L	M6	24" NPS Sch 100	300	11-Sep-85	223.0	513.8	3.175	20.0	2.541	6.359	1.785E+11
TD	18	PARENT	C-L	M6	24" NPS Sch 100	250	10-Sep-85	228.0	510.8	3.176	20.2	2.535	6.362	1.828E+11

TABLE IV - Data Sheet-J1-R Curve Test

```
                 TEST SPECIMEN DATA

SPECIMEN NUMBER                                       J1
MATERIAL TYPE                                         A106B
MATERIAL CONDITION                                    PARENT
TEST TEMPERATURE(DEG C)                               250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             228
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           510.8
CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
SPECIMEN THICKNESS B(CM)                              3.175
PERCENT SIDE GROOVE                                   19.779
SPECIMEN WIDTH W(CM)                                  6.365
YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
EFFECTIVE MODULUS(Pa)                                 2.00191091E+11

                 FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              18.62
INITIAL CRACK LENGTH-COMPLIANCE(CM)                   3.62

                 CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                        3.715
INITIAL A/W                                           .569
AVERAGE CRACK EXTENSION 9PT(CM)                       .613
DELTA A(CM) COMPLIANCE                                .565
MAX DEVIATION OF SINGLE MEASUREMENT %                 1.3

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                    19
LAST POINT                     25
JIC(KN/M)                      185
CORRELATION COEFF              .95
SLOPE M(MPa)                   94
INTERCEPT B (KN/M)             161

                 VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD       YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD          YES

                 QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                              YES
CRACK SIZE DA<0.15*DELTA A                            YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       470.43
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     402.66
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.745
25*JQ/EF.Y.(CM)                                       1.252

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED      19
LAST DATA POINT USED     36
CONSTANT(C1)             259.28
EXPONENT(C2)             .4025
```

TABLE V - Table of Various J Values

J1 (250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
13.13	.86	.02	.88	.88	.92	3.622	1
19.87	1.97	-.02	1.95	1.95	2.04	3.633	2
26.4	3.47	.22	3.69	3.69	3.87	3.624	3
33.11	5.46	.69	6.15	6.15	6.42	3.634	4
39.53	7.78	1.42	9.19	9.2	9.59	3.632	5
45.28	10.21	3.83	14.04	14.03	14.57	3.618	6
50.46	12.68	7.57	20.24	20.24	20.89	3.622	7
54.72	14.91	13.95	28.86	28.85	29.62	3.619	8
58.24	16.89	22.62	39.51	39.55	40.37	3.626	9
60.96	18.5	33.45	51.95	51.89	52.91	3.618	10
63.67	20.18	45.02	65.2	65.2	66.24	3.621	11
66.05	21.72	58.05	79.78	79.9	80.87	3.627	12
68.46	23.34	71.48	94.82	95.11	95.99	3.633	13
70.22	24.55	86.87	111.42	111.62	112.65	3.63	14
72.28	26.01	102.33	128.34	128.94	129.63	3.64	15
73.77	27.09	119.35	146.44	146.95	147.79	3.638	16
75.91	28.69	134.97	163.66	165.22	165.04	3.656	17
76.88	29.42	154.65	184.07	185.19	185.51	3.649	18
79.01	31.08	171.13	202.21	205.32	203.67	3.676	19
79.98	31.85	191.23	223.08	226.97	224.54	3.685	20
81.39	32.98	209.89	242.87	248.3	244.34	3.701	21
83.08	34.36	227.82	262.19	270.06	263.66	3.725	22
83.97	35.1	248.33	283.44	293.34	284.89	3.743	23
84.65	35.68	269.65	305.33	317.19	306.75	3.759	24
86.69	37.41	285.06	322.47	340.54	323.87	3.804	25
87.61	38.21	305.02	343.24	366.32	344.55	3.839	26
87.75	38.33	327.76	366.09	391.95	367.34	3.856	27
89.36	39.76	343.93	383.69	416.65	384.9	3.898	28
89.92	40.25	363.68	403.94	442.89	405.04	3.932	29
91.27	41.47	381.19	422.66	467.65	423.73	3.963	30
91.85	42.01	398.47	440.48	494.84	441.43	4.009	31
92.36	42.47	417.85	460.32	521.05	461.18	4.038	32
93.03	43.09	435.33	478.42	546.97	479.2	4.072	33
91.96	42.1	457.42	499.53	576.03	500.08	4.105	34
92.75	42.83	472.31	515.14	601.45	515.62	4.143	35
92.32	42.43	489.06	531.49	629.01	531.79	4.185	36

H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

TABLE VI - J-Δa Table

J1

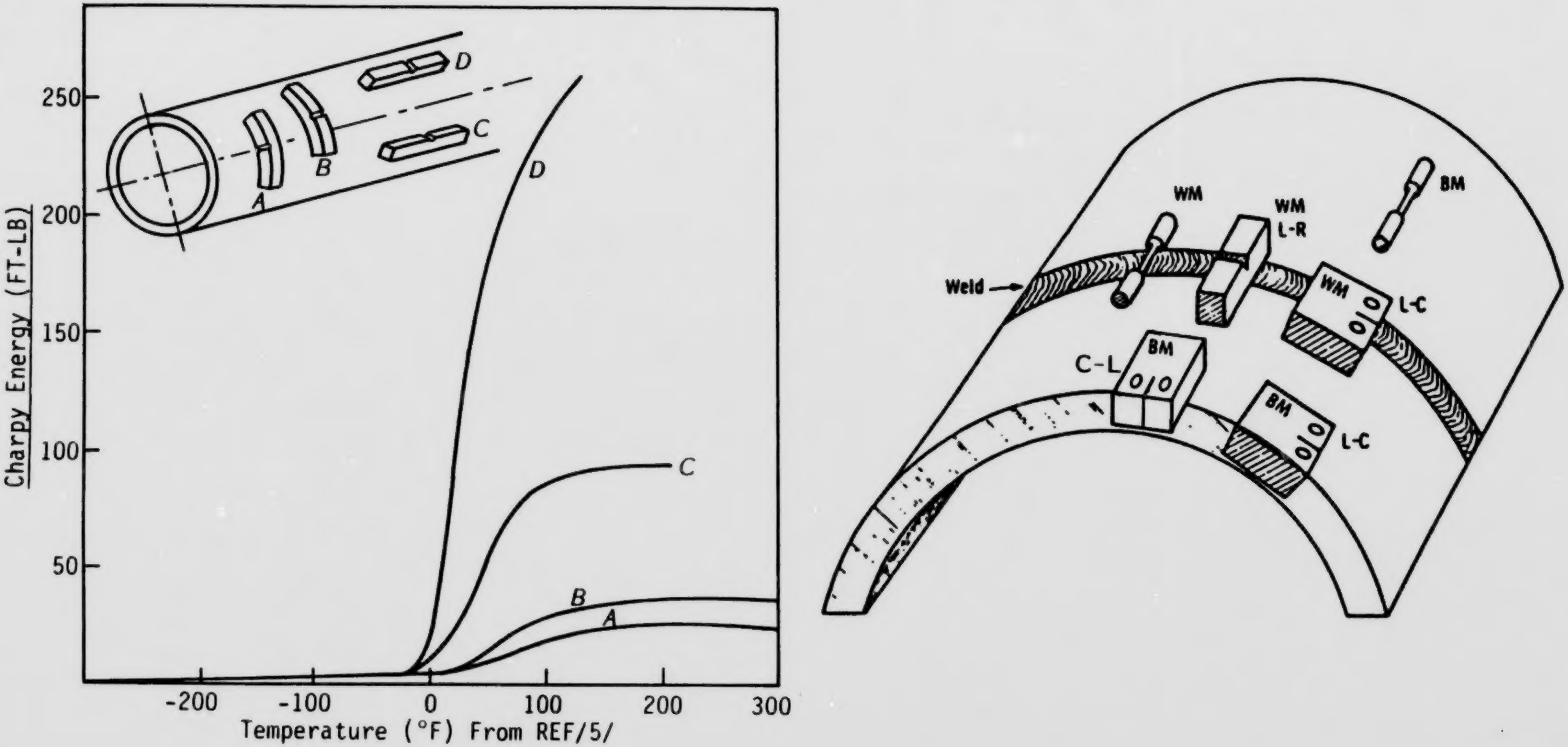
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.88	3.622	3.622	.022	.9995	1
1.95	3.633	3.633	.13	.9999	2
3.69	3.624	3.624	.043	.9998	3
6.15	3.633	3.634	.143	.9999	4
9.19	3.631	3.632	.125	.9999	5
14.04	3.616	3.618	-.025	.9998	6
20.24	3.62	3.622	.02	.9999	7
28.86	3.617	3.619	-5E-03	.9999	8
39.51	3.623	3.626	.061	.9999	9
51.95	3.614	3.618	-.022	.9999	10
65.2	3.617	3.621	.013	.9999	11
79.78	3.622	3.627	.071	.9999	12
94.82	3.627	3.633	.13	.9999	13
111.42	3.623	3.63	.103	.9998	14
128.34	3.632	3.64	.198	.9997	15
146.44	3.629	3.638	.18	.9999	16
163.66	3.647	3.656	.361	.9997	17
184.07	3.639	3.649	.294	.9995	18
202.21	3.665	3.676	.558	.9999	19
223.08	3.673	3.685	.651	.9997	20
242.87	3.688	3.701	.814	.9998	21
262.19	3.711	3.725	1.049	.9997	22
283.44	3.728	3.743	1.229	.9998	23
305.33	3.743	3.759	1.386	.9998	24
322.47	3.788	3.804	1.844	.9997	25
343.24	3.822	3.839	2.189	.9997	26
366.09	3.839	3.856	2.365	1	27
383.69	3.88	3.898	2.783	.9997	28
403.94	3.912	3.932	3.115	.9998	29
422.66	3.943	3.963	3.429	.9997	30
440.48	3.988	4.009	3.887	.9998	31
460.32	4.017	4.038	4.181	.9997	32
478.42	4.05	4.072	4.522	.9998	33
499.53	4.083	4.105	4.851	.9999	34
515.14	4.12	4.143	5.232	.9999	35
531.49	4.161	4.185	5.649	.9997	36

TABLE VII - Load vs Load Line Displacement Table

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J1
1	4.578	0	
2	7.751	.032	
3	11.658	.068	
4	15.564	.11	
5	19.409	.156	
6	23.193	.203	
7	26.794	.264	
8	29.785	.334	
9	32.349	.422	
10	34.302	.525	
11	36.072	.635	
12	37.598	.75	
13	38.879	.872	
14	40.161	.994	
15	41.26	1.121	
16	42.236	1.252	
17	43.152	1.384	
18	43.945	1.519	
19	44.678	1.658	
20	45.227	1.802	
21	45.532	1.951	
22	45.898	2.097	
23	46.204	2.246	
24	46.204	2.402	
25	46.143	2.561	
26	45.959	2.722	
27	45.471	2.896	
28	45.044	3.064	
29	44.678	3.232	
30	44.006	3.408	
31	43.762	3.574	
32	42.725	3.76	
33	42.114	3.936	
34	41.443	4.111	
35	40.039	4.309	
36	39.307	4.487	
37	37.964	4.683	

TABLE VIII - J-T-ω Table

	J(KN/M)	T	W	J1
1	193.14	92.03	9.57	
2	212.65	299.79	28.21	
3	232.98	162.84	13.9	
4	252.53	109.87	8.58	
5	272.81	158.45	11.37	
6	294.38	186.33	12.32	
7	313.9	50.18	3.06	
8	332.85	80.62	4.57	
9	354.66	173.81	9.18	
10	374.89	56.33	2.77	
11	393.82	81.73	3.77	
12	413.3	79.96	3.47	
13	431.57	52.06	2.12	
14	450.4	90.3	3.48	
15	469.37	71.24	2.6	
16	488.97	85.95	2.97	
17	507.33	54.79	1.79	
18	523.31	52.54	1.63	

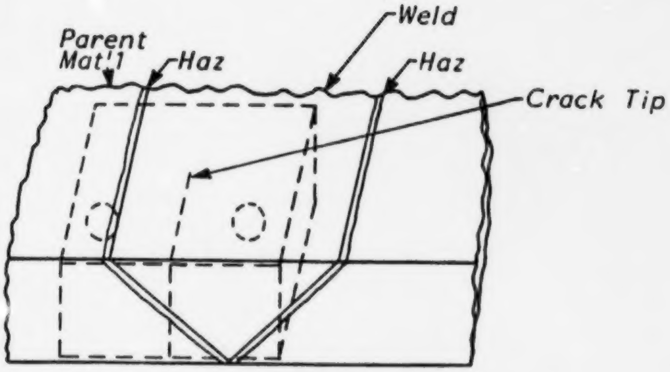


Legend	Crack Plane Orientation
A	(C-L)
B	(C-R)
C	(L-C)
D	(L-R)

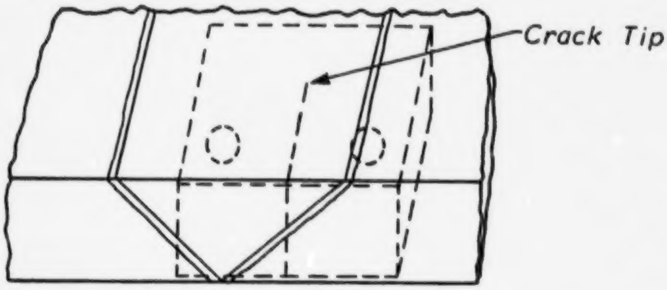
FIGURE 1

SPECIMEN ORIENTATION WITH RESPECT TO A PIPE GEOMETRY

(a) Left Side HAZ


Weld
Parent Mat'l
Haz
Haz
Crack Tip

(b) Right Side HAZ



.FIGURE 2

HAZ C(T) SPECIMEN ORIENTATIONS BOTH SIDES OF WELD

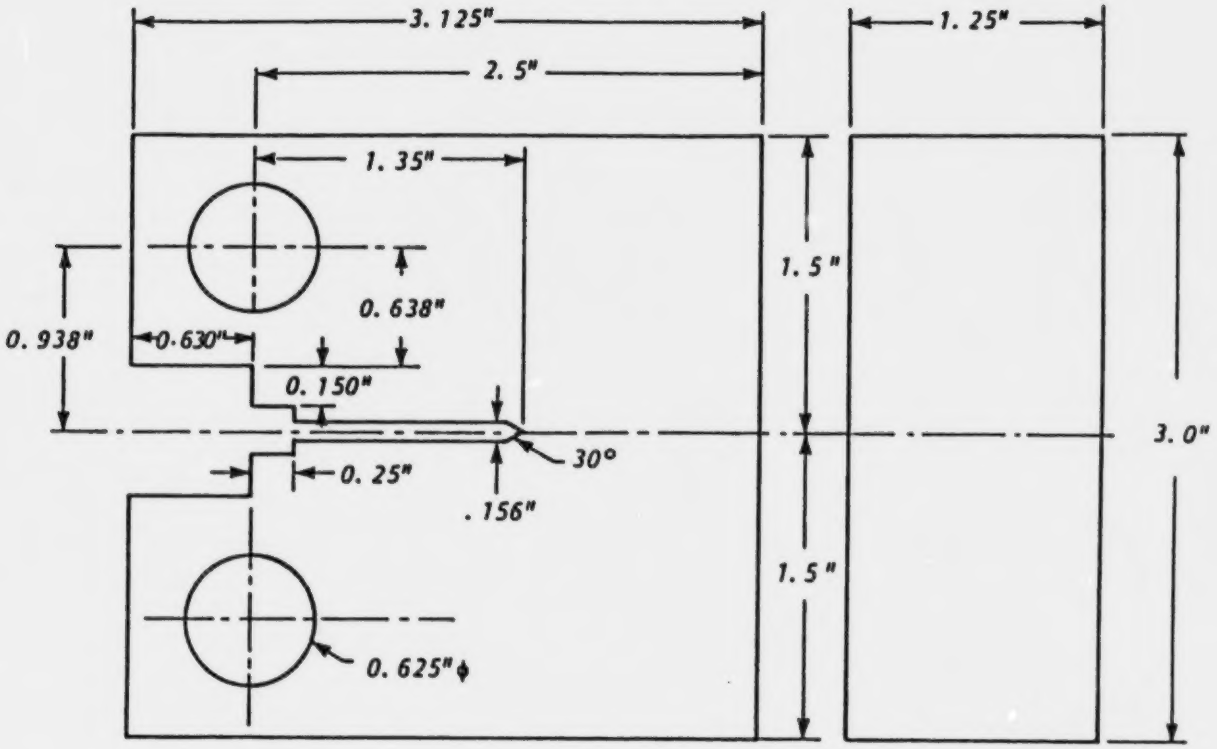

3. 125"
2. 5"
1. 25"
1. 35"
1. 5"
0. 638"
0. 938"
0.630"
0. 150"
0. 25"
30°
. 156"
3. 0"
1. 5"
0. 625"ϕ

FIGURE 3a
COMPACT TENSION SPECIMEN (1¼") MODIFIED FOR J INTEGRAL TESTING

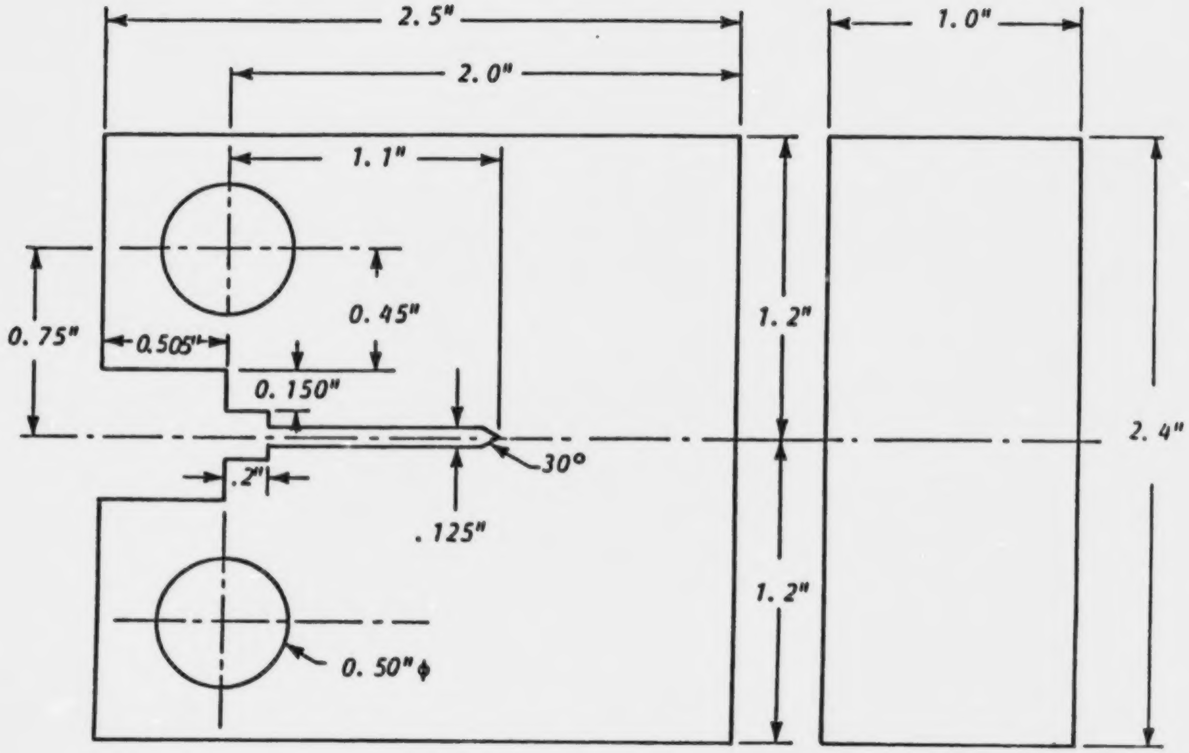

2.5"
2.0"
1.0"
1.1"
0.75"
0.505"
0.45"
0.150"
.2"
.125"
30°
1.2"
1.2"
2.4"
0.50" ϕ

FIGURE 3b

COMPACT TENSION SPECIMEN (1") MODIFIED FOR J INTEGRAL TESTING

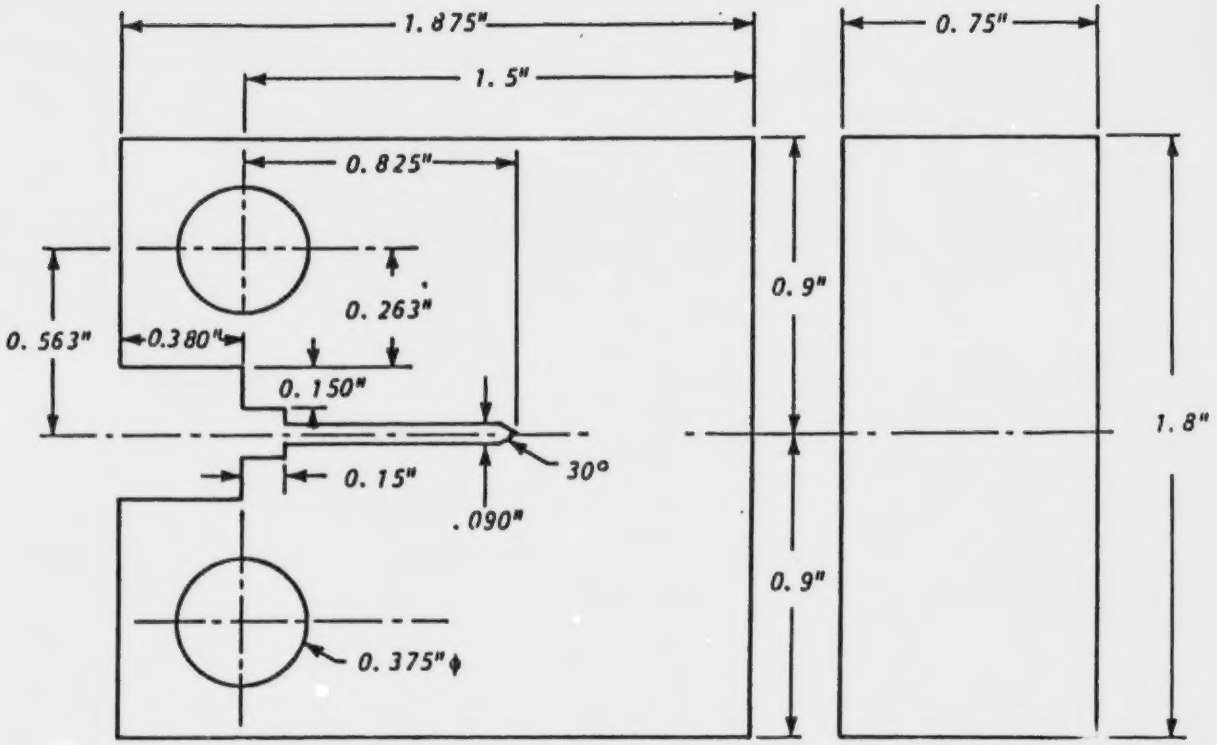

1.875"
1.5"
0.75"
0.825"
0.263"
0.563"
0.380"
0.150"
0.15"
.090"
30°
0.9"
0.9"
1.8"
0.375" ϕ

FIGURE 3c
COMPACT TENSION SPECIMEN (3/4") MODIFIED FOR J INTEGRAL TESTING

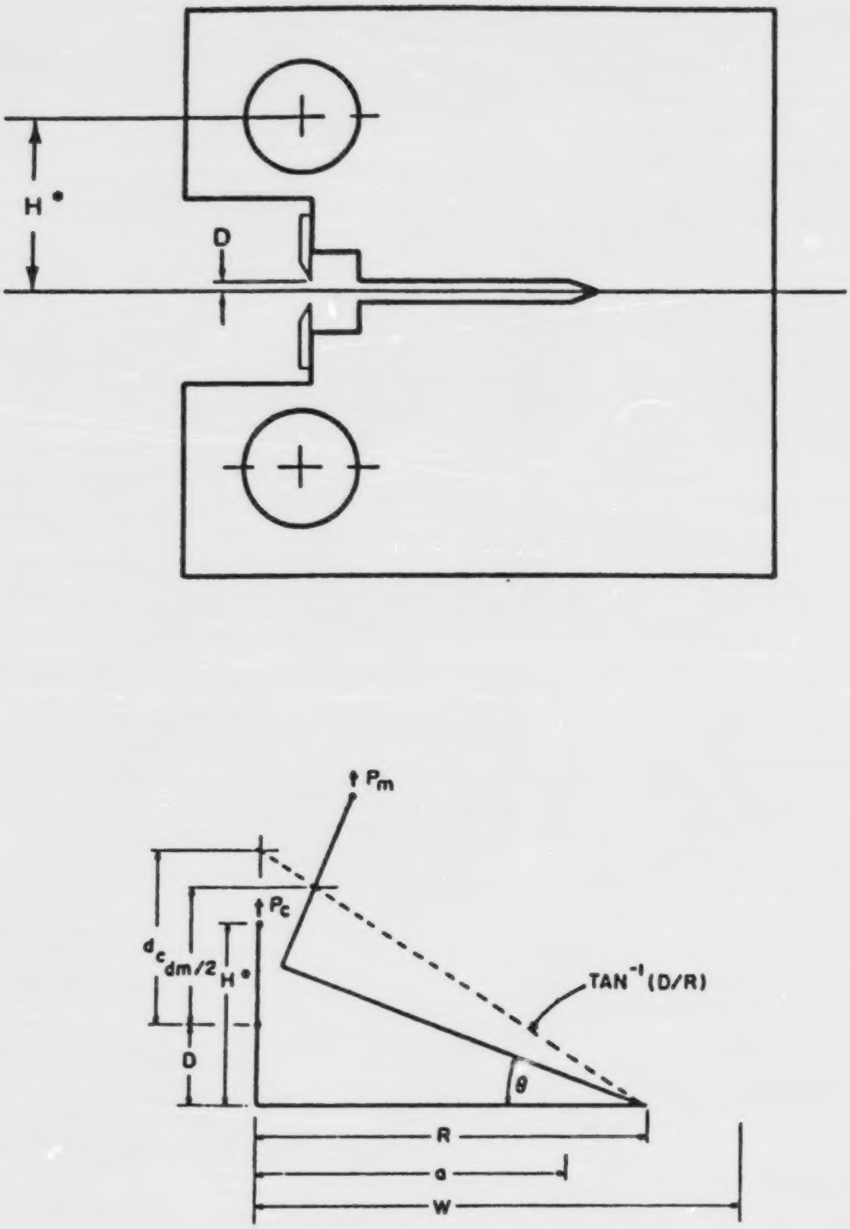

H*
D
P_m
P_c
d_c
dm/2
H*
D
TAN^-1 (D/R)
θ
R
a
W

FIGURE 4

ELASTIC COMPLIANCE CORRECTION FOR SPECIMEN ROTATION (FROM/2/)

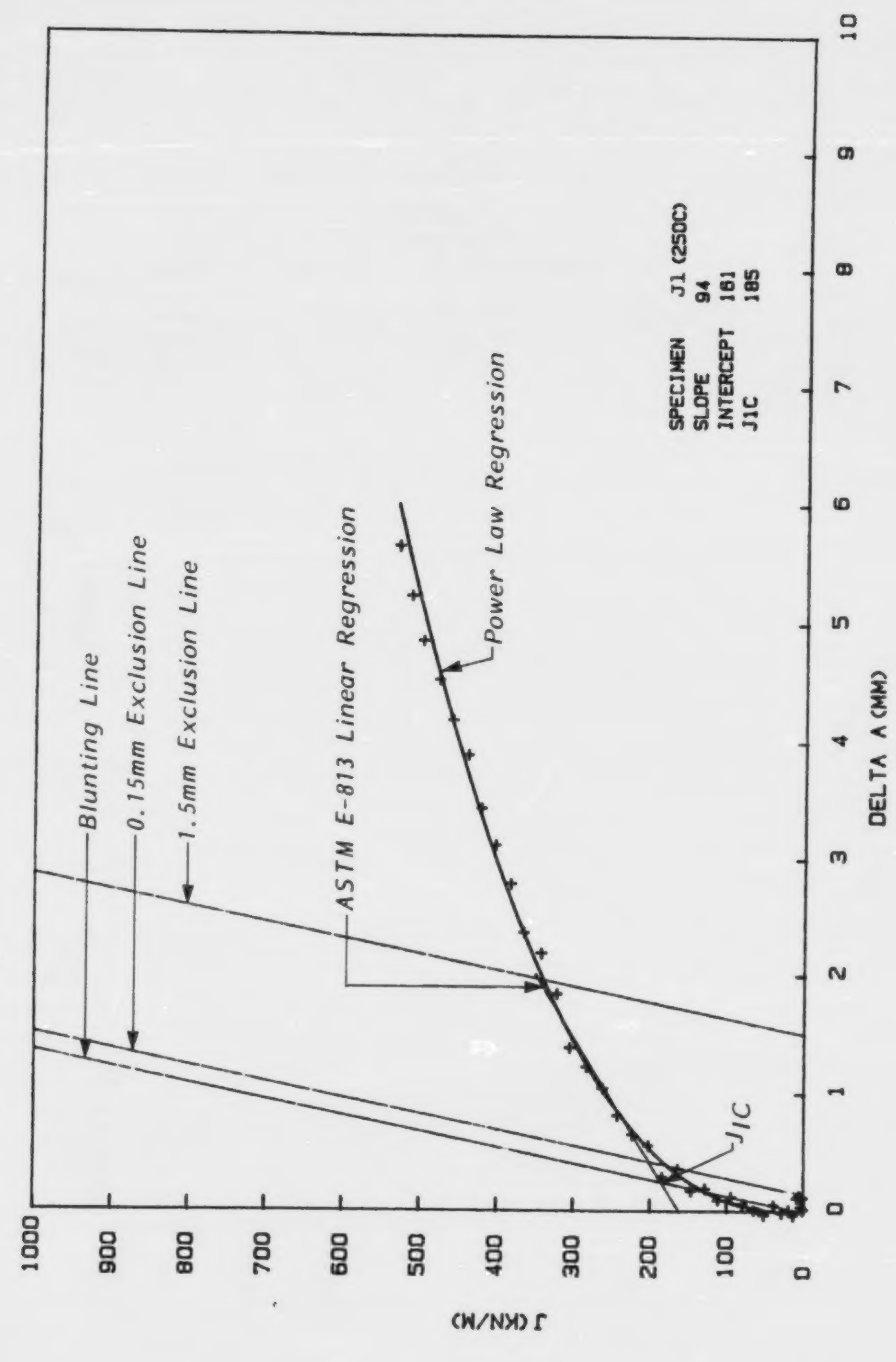


FIGURE 5
J-R CURVE

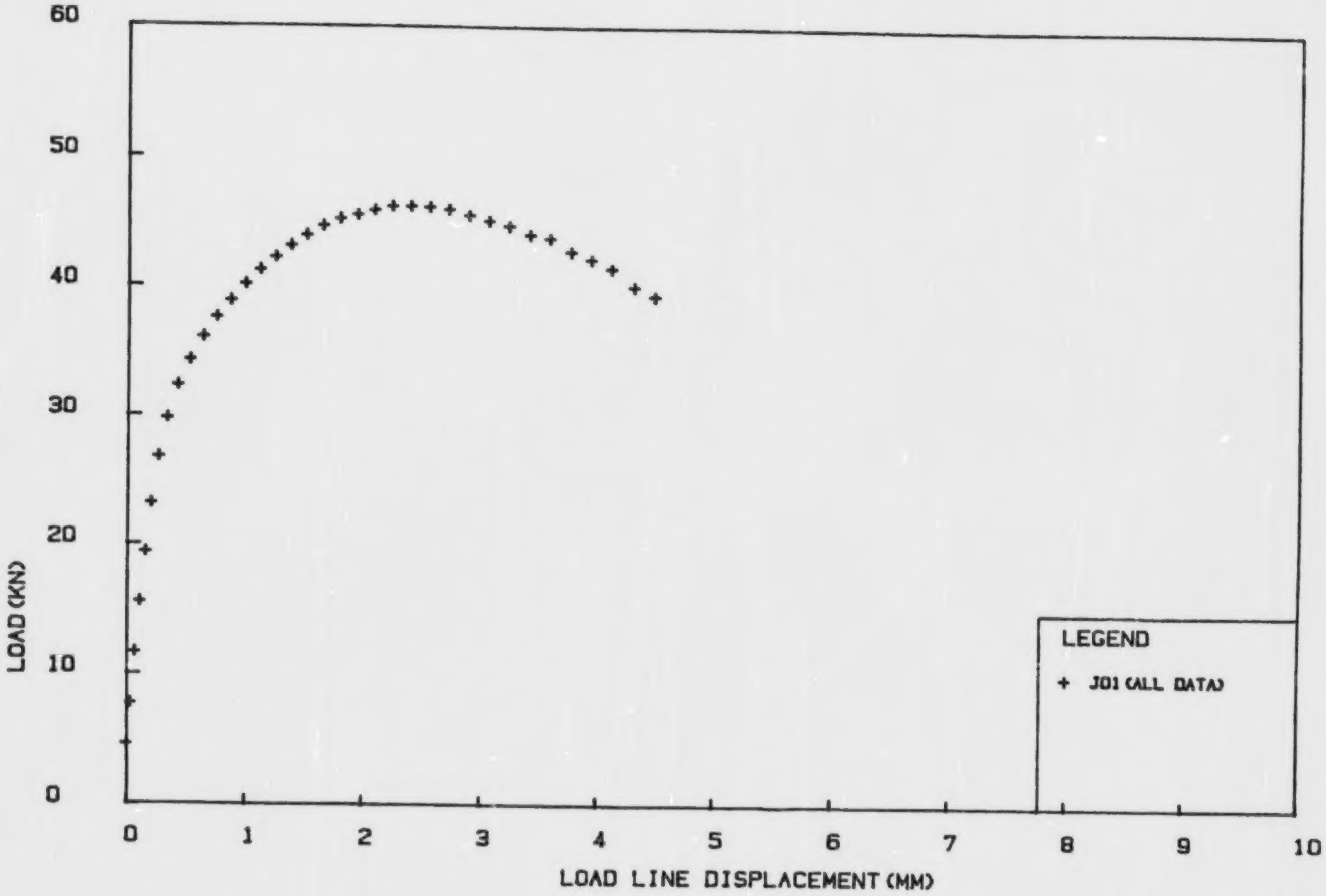


FIGURE 6

LOAD VS LOAD LINE DISPLACEMENT CURVE

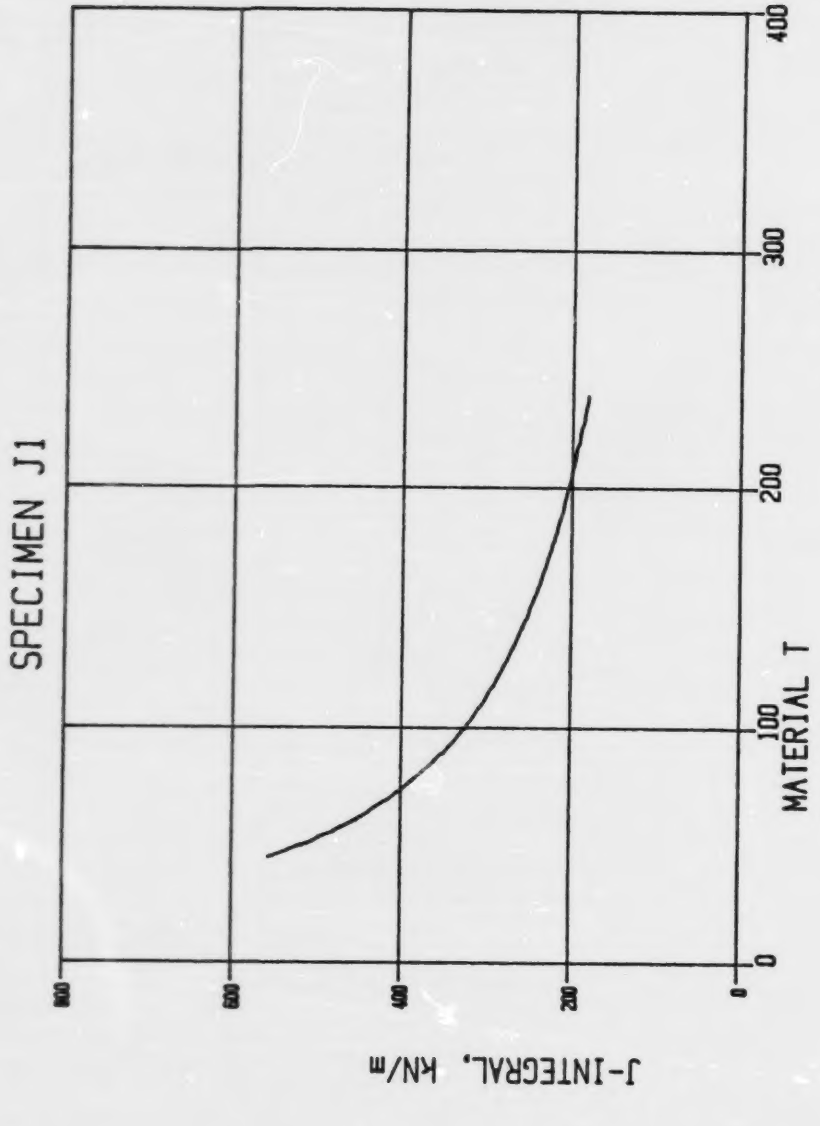


FIGURE 7
J VS MATERIAL T CURVE

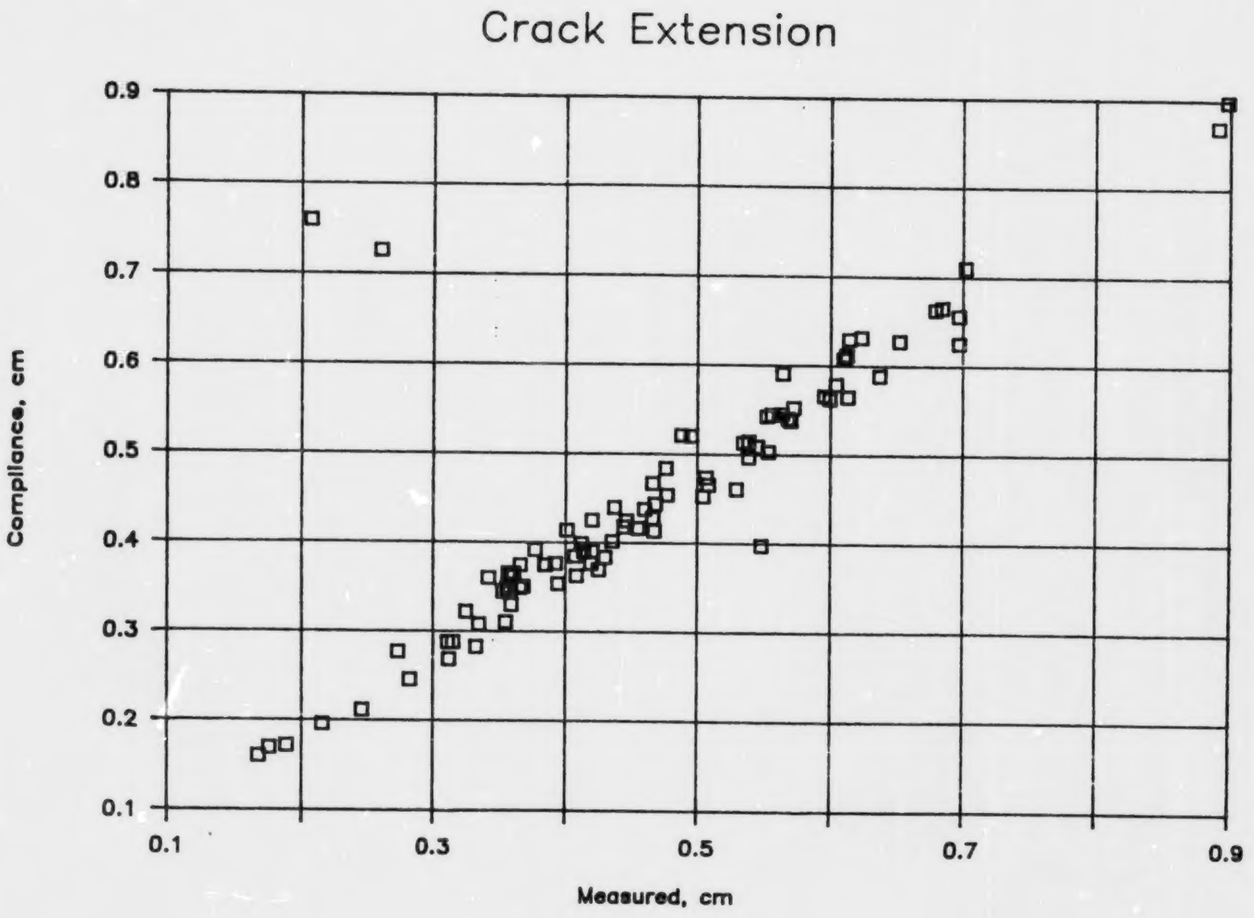


FIGURE 8

MEASURED VS CALCULATED CRACK EXTENSION FOR ALL SPECIMENS

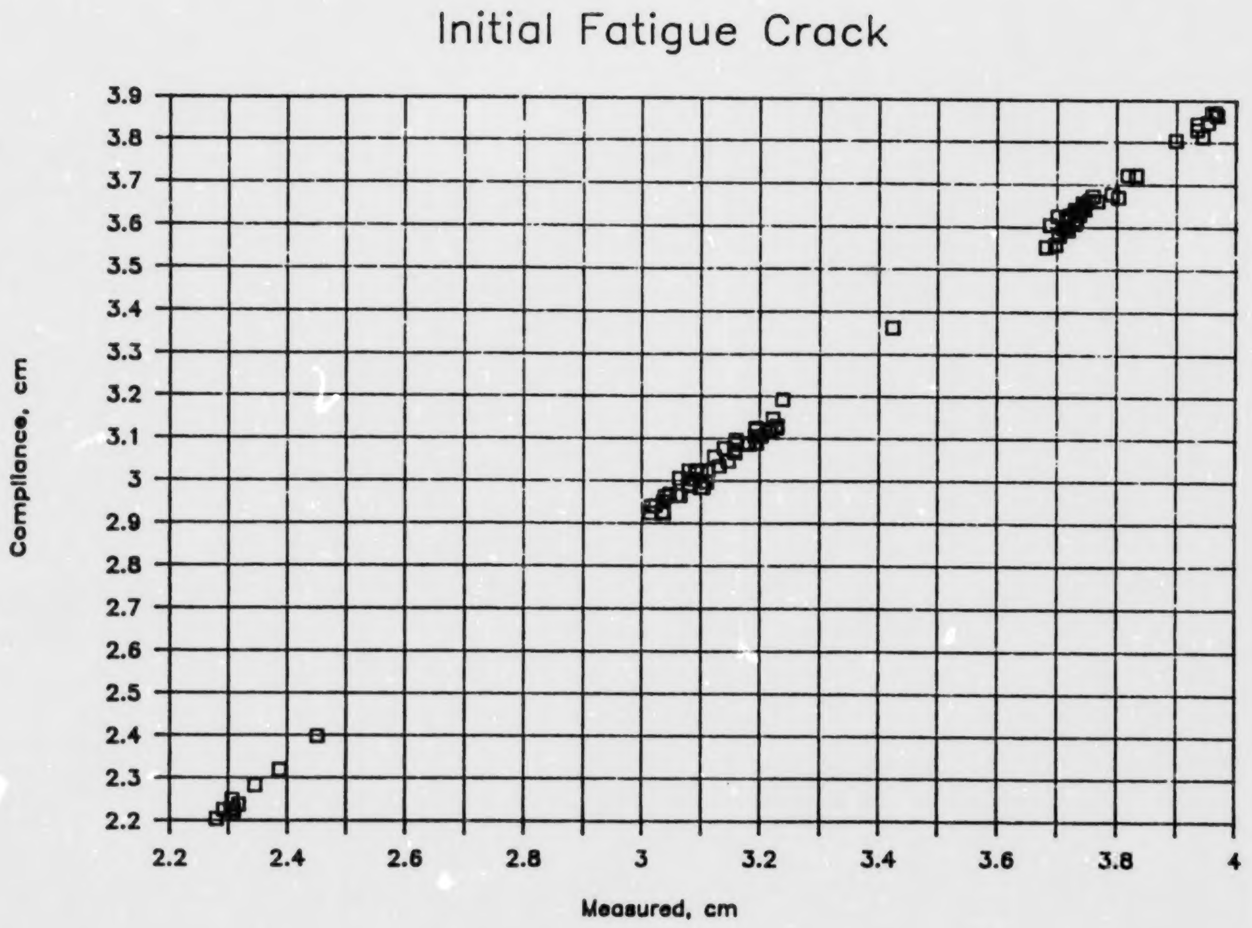


FIGURE 9
MEASURED VS CALCULATED INITIAL CRACK LENGTH FOR ALL SPECIMENS

APPENDIX A

Procedure for Preparing Test Coupons

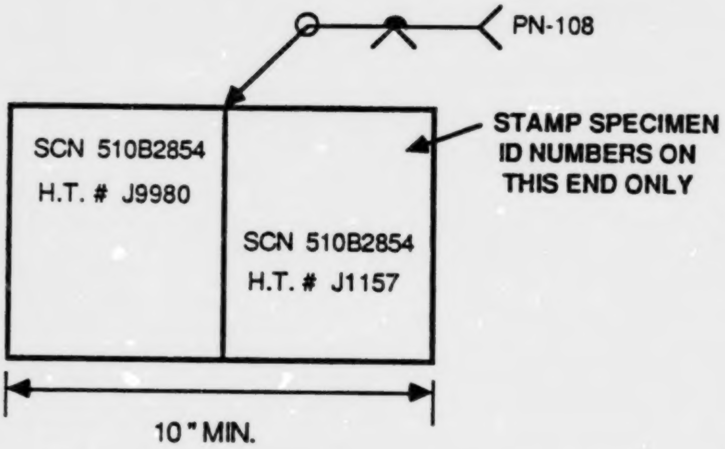
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : **A**

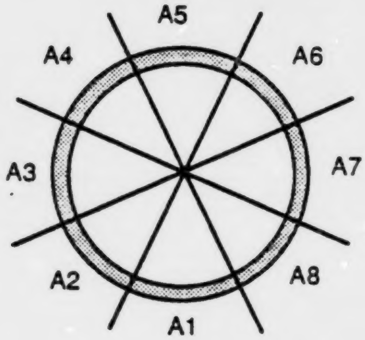
MATERIAL : SA106 GR B TO SA 106 GR B

NPS 24 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN-108
SCN 510B2854
H.T. # J9980
SCN 510B2854
H.T. # J1157
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10 " MIN.

SAW CUT (8 SPECIMENS)


A5
A4
A6
A3
A7
A2
A8
A1

(6 O'CLOCK POSITION.)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP. COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-108 (WHERE APPLICABLE USE MAX. BEAD WIDTH AS PERMITTED BY WPS)
4. RADIOGRAPHY OF WELD
5. PWHT (HOLDING TIME 4 HOURS)
6. MT OR PT WELD
7. SAW CUT WELDED COUPON (8 SPECIMENS)
8. MAINTAIN TRACEABILITY AND RECORDS.

REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

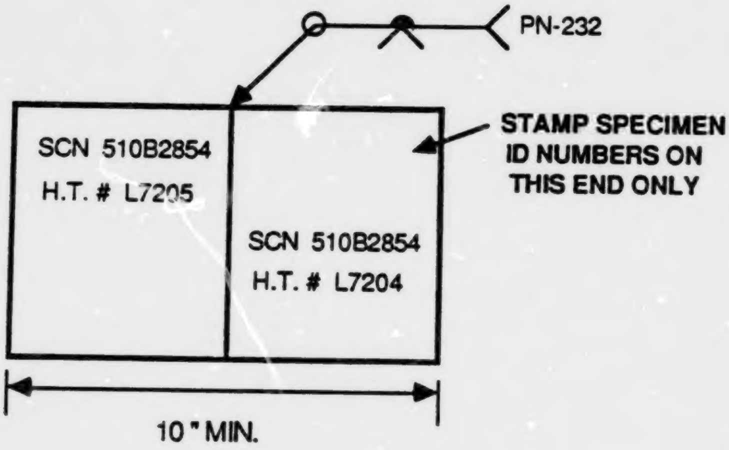
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : **B**

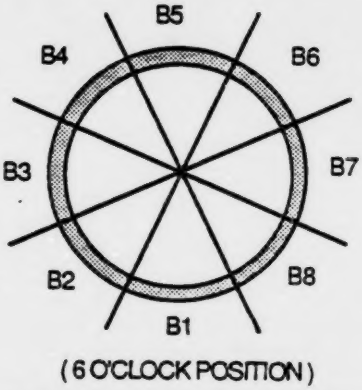
MATERIAL : SA106 GR B TO SA 106 GR B

NPS 24 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN-232
SCN 510B2854
H.T. # L7205
SCN 510B2854
H.T. # L7204
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10 " MIN.

SAW CUT (8 SPECIMENS)


B5
B4
B6
B3
B7
B2
B8
B1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP. COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-232
4. RADIOGRAPHY OF WELD
5. PWHT (HOLDING TIME 2 HOURS)
6. MT OR PT WELD
7. SAW CUT WELDED COUPON (8 SPECIMENS)
8. MAINTAIN TRACEABILITY AND RECORDS.

REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

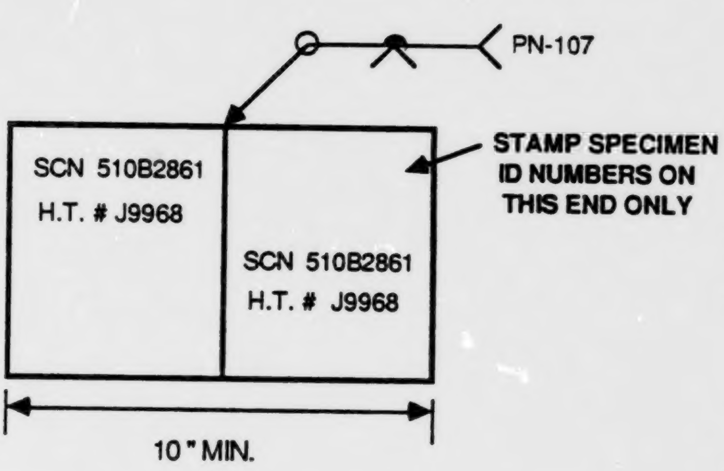
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : C

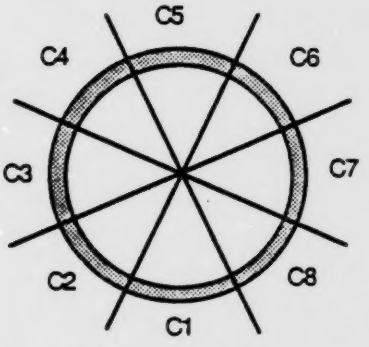
MATERIAL : SA106 GR B TO SA 106 GR B

NPS 22 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN-107
SCN 510B2861
H.T. # J9968
SCN 510B2861
H.T. # J9968
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10" MIN.

SAW CUT (8 SPECIMENS)


C5
C4
C6
C3
C7
C2
C8
C1

(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP. COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-107. (WHERE APPLICABLE USE MAX. BEAD WIDTH AS PERMITTED BY WPS)
4. RADIOGRAPHY OF WELD
5. MT OR PT WELD
6. SAW CUT WELDED COUPON (8 SPECIMENS)
7. MAINTAIN TRACEABILITY AND RECORDS.

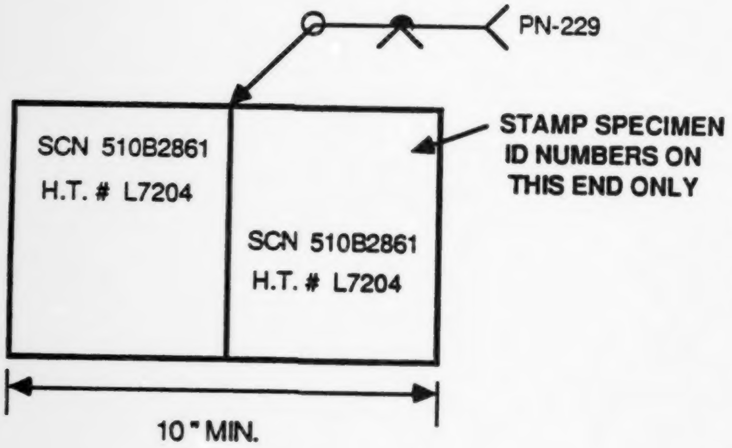
REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

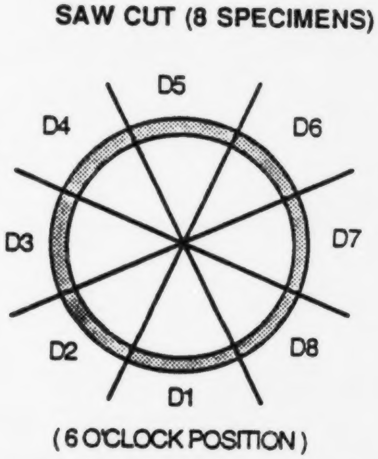
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : D

MATERIAL : SA106 GR B TO SA 106 GR B
NPS 22 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN-229
SCN 510B2861
H.T. # L7204
SCN 510B2861
H.T. # L7204
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10 " MIN.


SAW CUT (8 SPECIMENS)
D5
D4
D6
D3
D7
D2
D8
D1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS
(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP. COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-229
4. RADIOGRAPHY OF WELD
5. MT OR PT WELD
6. SAW CUT WELDED COUPON (8 SPECIMENS)
7. MAINTAIN TRACEABILITY AND RECORDS.

REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

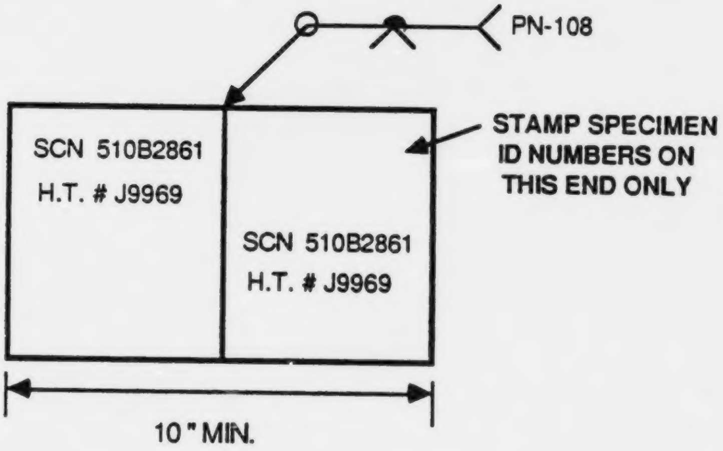
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

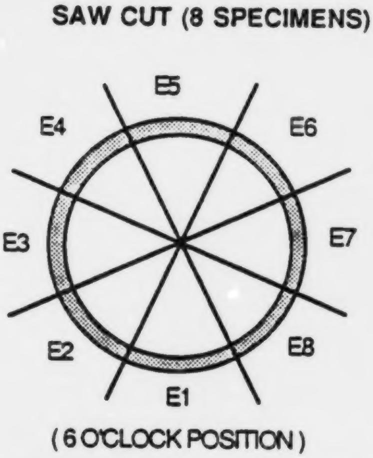
COUPON NUMBER : E

MATERIAL : SA106 GR B TO SA 106 GR B

NPS 22 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN-108
SCN 510B2861
H.T. # J9969
SCN 510B2861
H.T. # J9969
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10 " MIN.


SAW CUT (8 SPECIMENS)
E5
E4
E6
E3
E7
E2
E8
E1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP. COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-108. (WHERE APPLICABLE USE MAX. BEAD WIDTH AS PERMITTED BY WPS)
4. RADIOGRAPHY OF WELD
5. PWHT (HOLDING TIME 2 HOURS)
6. MT OR PT WELD
7. SAW CUT WELDED COUPON (8 SPECIMENS)
8. MAINTAIN TRACEABILITY AND RECORDS.

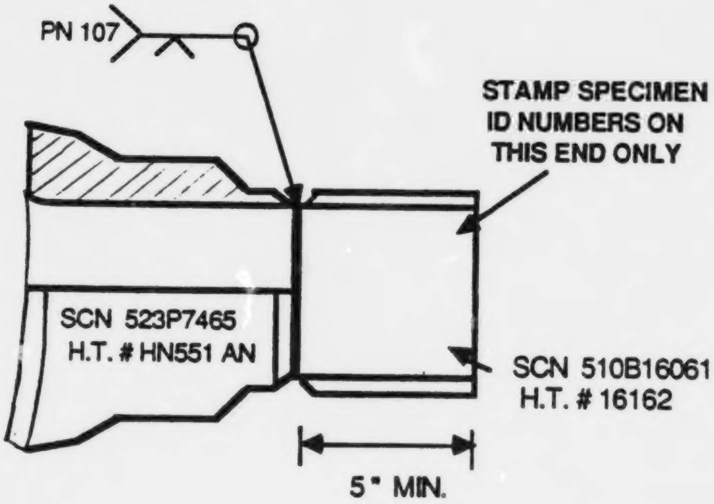
REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

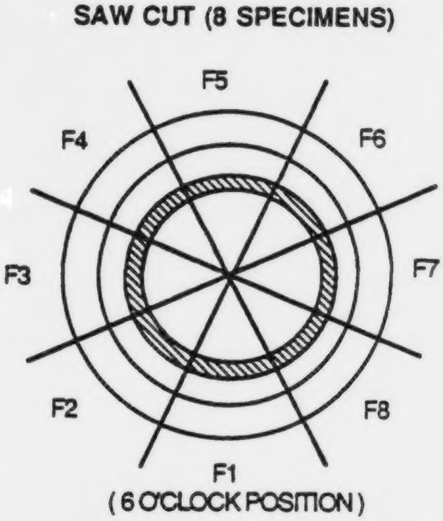
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : F

MATERIAL : VESSELET SA-105 22 x 12 SCH 100
PIPE NPS 12 SCH 100

NOTE : Welding and NDE in accordance with ASME III Class 1


PN 107
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
SCN 523P7465
H.T. # HN551 AN
SCN 510B16061
H.T. # 16162
5" MIN.


SAW CUT (8 SPECIMENS)
F5
F4
F6
F3
F7
F2
F8
F1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS
(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. WELD PREP COUPONS
2. STAMP SPECIMEN ID NUMBERS
3. WELDING PER OH WPS PN-107 (WHERE APPLICABLE USE MAX. BEAD WIDTH AS PERMITTED BY WPS)
4. RADIOGRAPHY OF WELD
5. MT OR PT WELD
6. SAW CUT WELDED COUPON (8 SPECIMENS)
7. MAINTAIN TRACEABILITY

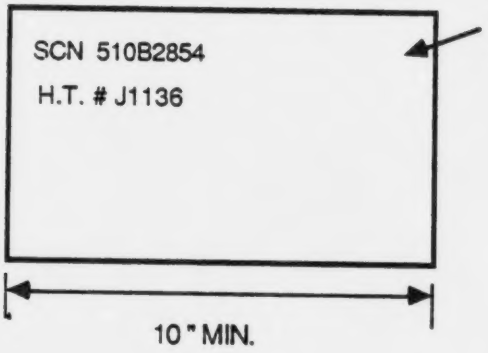
REV. 0 MARCH 12 1985
REV. 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : M

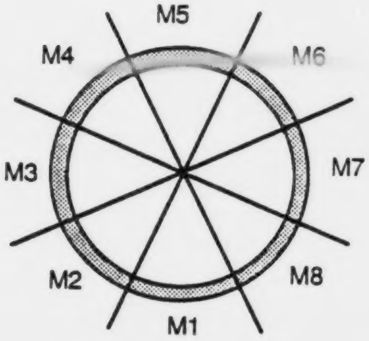
MATERIAL : SA106 GR B

NPS 24 SCH 100



STAMP SPECIMEN ID NUMBERS ON THIS END ONLY

SAW CUT (8 SPECIMENS)



(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. PREPARE 10" LONG COUPON
2. STAMP SPECIMEN ID NUMBERS
3. SAW CUT 8 SPECIMENS
4. MAINTAIN TRACEABILITY

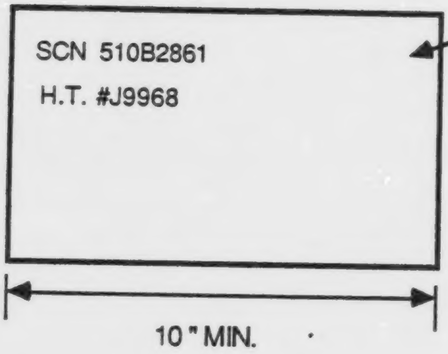
REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : N

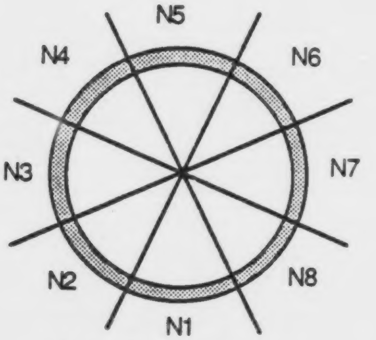
MATERIAL : SA106 GR B

NPS 22 SCH 100



STAMP SPECIMEN ID NUMBERS ON THIS END ONLY

SAW CUT (8 SPECIMENS)



(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. PREPARE 10" LONG COUPON
2. STAMP SPECIMEN ID NUMBERS
3. SAW CUT 8 SPECIMENS
4. MAINTAIN TRACEABILITY

REV. 0 MARCH 12 1985

REV 1 APRIL 12 1985

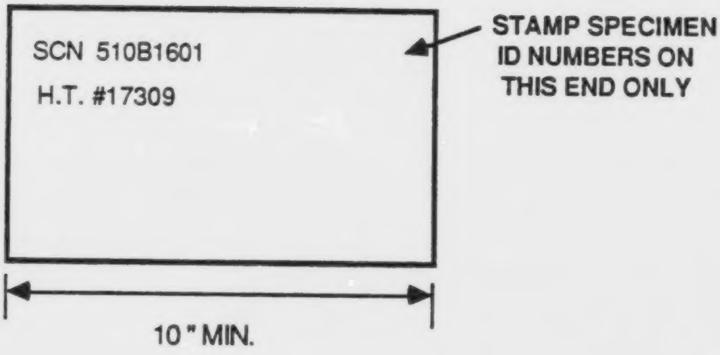
ISSUED BY : M. LAU
MECHANICAL DESIGN

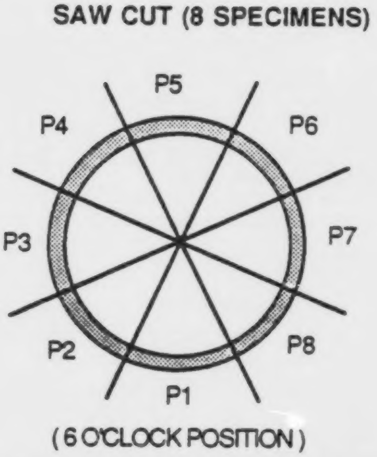
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : P

MATERIAL : SA106 GR B

NPS 12 SCH 100


SCN 510B1601
H.T. #17309
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10" MIN.


SAW CUT (8 SPECIMENS)
P5
P4
P6
P3
P7
P2
P8
P1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

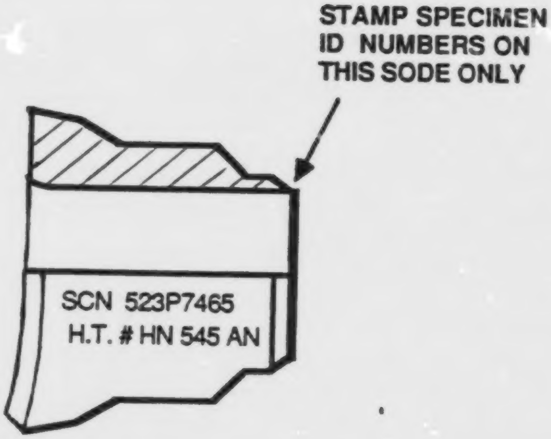
1. PREPARE 10" LONG COUPON
2. STAMP SPECIMEN ID NUMBERS
3. SAW CUT 8 SPECIMENS
4. MAINTAIN TRACEABILITY

REV. 0 MARCH 12 1985
REV 1 APRIL 12 1985
ISSUED BY : M. LAU
MECHANICAL DESIGN

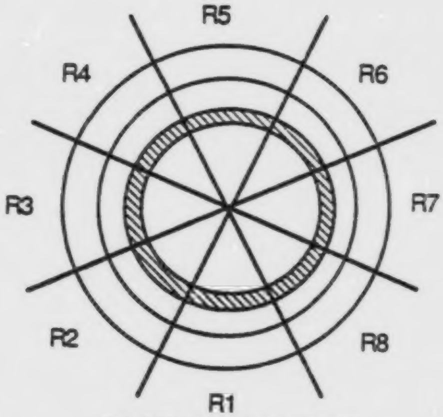
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : **R**

MATERIAL : VESSELET SA-105 22 x 12 SCH 100


STAMP SPECIMEN
ID NUMBERS ON
THIS SODE ONLY
SCN 523P7465
H.T. # HN 545 AN

SAW CUT (8 SPECIMENS)


R5
R4
R6
R3
R7
R2
R8
R1

(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. STAMP ID FOR 8 SPECIMENS
2. SAW CUT 8 SPECIMENS
3. MAINTAIN TREACEABLITY

REV. 0 MARCH 12 1985
REV. 1 APRIL 12 1985
ISSUED BY : M. LAU

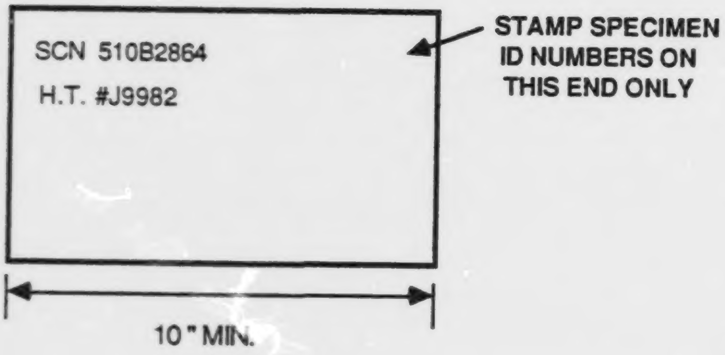
MECHANICAL DESIGN

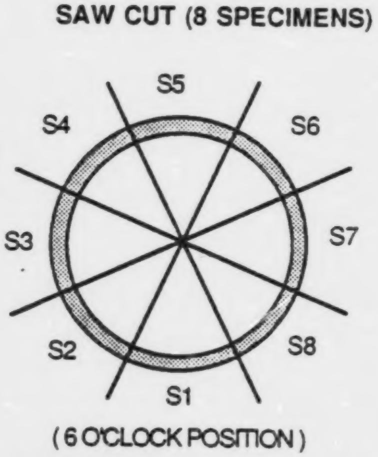
DARLINGTON LEAK-BEFORE-BREAK MATERIAL TEST PROGRAM

COUPON NUMBER : S

MATERIAL : SA106 GR B

NPS 24 SCH 100


SCN 510B2864
H.T. #J9982
STAMP SPECIMEN ID NUMBERS ON THIS END ONLY
10" MIN.


SAW CUT (8 SPECIMENS)
S5
S4
S6
S3
S7
S2
S8
S1
(6 O'CLOCK POSITION)

SPECIMEN ID NUMBERS

(MARK HEAT # ON EACH SPECIMEN)

PROCEDURE FOR PREPARING TEST COUPONS

1. PREPARE 10" LONG COUPON
2. STAMP SPECIMEN ID NUMBERS
3. SAW CUT 8 SPECIMENS
4. MAINTAIN TRACEABILITY

REV. 0 MARCH 12 1985

REV. 1 APRIL 12 1985

ISSUED BY : M. LAU
MECHANICAL DESIGN

APPENDIX B

Summary Table of Test Results

DARLINGTON LBB A106B MATERIAL DATA SUMMARY TABLE

	TEST NO	MATERIAL	DIRECTION OF TEST	COUPON NO	DESCRIPTION	TEST TEMP C	DATE	YIELD STRESS MPa	ULTIMATE STRESS MPa	THICKNESS B cm	SIDE GROOVE %	Bn cm	WIDTH W cm	YOUNGS MODULUS Pa
J	1	PARENT	L-C	M1	24" NPS Sch 100	250	23-May-86	228.0	510.8	3.175	19.8	2.547	6.365	1.828E+11
J	2	PARENT	L-C	M1	24" NPS Sch 100	250	17-Sep-85	226.0	510.8	3.174	19.8	2.547	6.361	1.828E+11
J	3	PARENT	L-C	S1	24" NPS Sch 100	250	18-Sep-85	228.0	510.8	3.175	19.6	2.552	6.364	1.828E+11
J	4	WELD PN-108	L-C	A1	24" NPS Sch 100	250	20-Sep-85	275.3	482.0	3.047	21.2	2.400	6.360	1.828E+11
J	5	WELD PN-108	L-C	A1	24" NPS Sch 100	250	19-Sep-85	275.3	482.0	3.046	21.2	2.400	6.365	1.828E+11
J	6	WELD PN-108	L-C	A3	24" NPS Sch 100	250	23-Sep-85	275.3	482.0	3.048	21.0	2.409	6.361	1.828E+11
J	7	HAZ PN-108	L-C	A2	24" NPS Sch 100	250	21-Jan-86	275.3	482.0	3.053	21.4	2.460	6.360	1.828E+11
J	8	HAZ PN-108	L-C	A2	24" NPS Sch 100	250	20-Jan-86	275.3	482.0	2.901	21.3	2.284	6.297	1.828E+11
J	9	WELD PN-232	L-C	B1	24" NPS Sch 100	250	24-Sep-85	249.3	423.4	3.047	21.1	2.403	6.359	1.828E+11
J	10	WELD PN-232	L-C	B1	24" NPS Sch 100	250	25-Sep-85	249.3	423.4	3.046	20.9	2.410	6.361	1.828E+11
J	11	WELD PN-232	L-C	B3	24" NPS Sch 100	250	26-Sep-85	249.3	423.4	3.051	21.4	2.398	6.360	1.828E+11
J	12	HAZ PN-232	L-C	B2	24" NPS Sch 100	250	23-Jan-86	249.3	423.4	3.040	20.5	2.418	6.351	1.828E+11
J	13	HAZ PN-232	L-C	B2	24" NPS Sch 100	250	22-Jan-86	249.3	423.4	3.055	20.3	2.434	6.300	1.828E+11
J	14	PARENT	L-C	N1	22" NPS Sch 100	20	26-Nov-85	320.3	532.6	3.048	19.4	2.458	6.349	1.923E+11
J	15	PARENT	L-C	N1	22" NPS Sch 100	20	25-Nov-85	320.3	532.6	3.050	19.3	2.461	6.349	1.923E+11
J	16	PARENT	L-C	N2	22" NPS Sch 100	20	29-Nov-85	320.3	532.6	3.050	19.3	2.461	6.349	1.923E+11
J	17	PARENT	L-C	N1	22" NPS Sch 100	250	28-Nov-85	220.7	508.5	3.049	19.3	2.460	6.347	1.828E+11
J	18	PARENT	L-C	N2	22" NPS Sch 100	250	28-Nov-85	220.7	508.5	3.049	19.4	2.459	6.344	1.828E+11
J	19	PARENT	L-C	N2	22" NPS Sch 100	250	27-Nov-85	220.7	508.5	3.049	19.5	2.455	6.345	1.828E+11
J	20	WELD PN-107	L-C	C1	22" NPS Sch 100	20	23-Oct-85	347.7	547.2	2.541	20.1	2.030	5.095	1.923E+11
J	21	WELD PN-107	L-C	C1	22" NPS Sch 100	20	24-Oct-85	347.7	547.2	2.542	21.5	1.995	5.090	1.923E+11
J	22	WELD PN-107	L-C	C2	22" NPS Sch 100	20	25-Oct-85	347.7	547.2	2.540	20.9	2.008	5.093	1.923E+11
J	23	WELD PN-107	L-C	C4	22" NPS Sch 100	250	18-Oct-85	353.7	542.3	2.540	20.8	2.012	5.092	1.828E+11
J	24	WELD PN-107	L-C	C2	22" NPS Sch 100	250	21-Oct-85	353.7	542.3	2.541	20.7	2.015	5.091	1.828E+11
J	25	WELD PN-107	L-C	C4	22" NPS Sch 100	250	22-Oct-85	353.7	542.3	2.540	20.5	2.020	5.090	1.828E+11
J	26	HAZ PN-107	L-C	C3	22" NPS Sch 100	20	03-Dec-85	347.7	547.2	2.537	21.0	2.005	5.062	1.923E+11
J	27	HAZ PN-107	L-C	C3	22" NPS Sch 100	20	04-Dec-85	347.7	547.2	2.540	20.6	2.017	5.082	1.923E+11
J	28	HAZ PN-107	L-C	C6	22" NPS Sch 100	250	14-Nov-85	353.7	542.3	2.538	21.0	2.006	5.084	1.828E+11
J	29	HAZ PN-107	L-C	C6	22" NPS Sch 100	250	13-Nov-85	353.7	542.3	2.540	21.0	2.007	5.084	1.828E+11
J	30	WELD PN-229	L-C	D1	22" NPS Sch 100	20	28-Oct-85	367.0	516.1	2.540	20.8	2.011	5.095	1.923E+11
J	31	WELD PN-229	L-C	D1	22" NPS Sch 100	20	29-Oct-85	367.0	516.1	2.540	20.5	2.019	5.091	1.923E+11
J	32	WELD PN-229	L-C	D2	22" NPS Sch 100	20	30-Oct-85	367.0	516.1	2.540	20.8	2.012	5.095	1.923E+11
J	33	WELD PN-229	L-C	D4	22" NPS Sch 100	250	27-Sep-85	364.0	553.1	2.540	20.7	2.014	5.093	1.828E+11
J	34	WELD PN-229	L-C	D2	22" NPS Sch 100	250	30-Sep-85	364.0	553.1	2.540	20.5	2.020	5.091	1.828E+11
J	35	WELD PN-229	L-C	D4	22" NPS Sch 100	250	01-Oct-85	364.0	553.1	2.541	20.4	2.022	5.093	1.828E+11
J	36	HAZ PN-229	L-C	D3	22" NPS Sch 100	20	11-Nov-85	367.0	516.1	2.540	21.1	2.003	5.084	1.923E+11
J	37	HAZ PN-229	L-C	D3	22" NPS Sch 100	20	12-Nov-85	367.0	516.1	2.540	21.4	1.996	5.083	1.923E+11
J	38	HAZ PN-229	L-C	D6	22" NPS Sch 100	250	08-Nov-85	364.0	553.7	2.539	21.4	1.996	5.082	1.828E+11
J	39	HAZ PN-229	L-C	D6	22" NPS Sch 100	250	07-Nov-85	364.0	553.7	2.540	20.9	2.009	5.085	1.828E+11
J	40	WELD PN-108	L-C	E1	22" NPS Sch 100	250	02-Oct-85	273.0	479.8	2.538	21.1	2.002	5.091	1.828E+11
J	41	WELD PN-108	L-C	E1	22" NPS Sch 100	250	03-Oct-85	273.0	479.8	2.544	21.2	2.004	5.091	1.828E+11
J	42	WELD PN-108	L-C	E2	22" NPS Sch 100	250	04-Oct-85	273.0	479.8	2.540	21.2	2.001	5.093	1.828E+11
J	43	HAZ PN-108	L-C	E2	22" NPS Sch 100	250	05-Nov-85	273.0	479.8	2.540	21.2	2.002	5.083	1.828E+11
J	44	HAZ PN-108	L-C	E2	22" NPS Sch 100	250	06-Nov-85	273.0	479.8	2.539	20.3	2.024	5.082	1.828E+11
J	45	PARENT	L-C	P1	12" NPS Sch100	250	17-Jan-86	267.3	559.3	1.908	20.3	1.521	3.810	1.828E+11
J	46	PARENT	L-C	P1	12" NPS Sch100	250	16-Jan-86	267.3	559.3	1.906	21.0	1.505	3.809	1.828E+11

DARLINGTON LBB A106B MATERIAL DATA SUMMARY TABLE

	TEST NO	MATERIAL	DIRECTION OF TEST	COUPON NO	DESCRIPTION	TEST TEMP C	DATE	YIELD STRESS MPa	ULTIMATE STRESS MPa	THICKNESS B cm	SIDE GROOVE %	Bn cm	WIDTH W cm	YOUNGS MODULUS Pa
J	47	PARENT	L-C	P2	12" NPS Sch100	250	15-Jan-86	267.3	559.3	1.905	20.2	1.520	3.809	1.828E+11
J	48	WELD PN-107	L-C	F1	12" NPS Sch100	250	14-Jan-86	324.0	548.2	1.589	20.8	1.259	3.810	1.828E+11
J	49	WELD PN-107	L-C	F1	12" NPS Sch100	250	13-Jan-86	324.0	548.2	1.637	20.4	1.303	3.809	1.828E+11
J	50	WELD PN-107	L-C	F2	12" NPS Sch100	250	09-Jan-86	324.0	548.2	1.637	19.3	1.321	3.808	1.828E+11
J	51	HAZ PN-107	L-C	F3	12" NPS Sch100	250	08-Jan-86	324.0	548.2	1.637	18.6	1.333	3.804	1.828E+11
J	52	HAZ PN-107	L-C	F3	12" NPS Sch100	250	07-Jan-86	324.0	548.2	1.637	18.9	1.328	3.813	1.828E+11
J	53	PARENT	L-C	R1	22"*12" VESSELET	20	29-Nov-85	322.7	560.6	2.540	21.1	2.005	5.079	1.923E+11
J	54	PARENT	L-C	R1	22"*12" VESSELET	20	02-Dec-85	322.7	560.6	2.540	21.6	1.991	5.083	1.923E+11
J	55	PARENT	L-C	R2	22"*12" VESSELET	20	02-Dec-85	322.7	560.6	2.541	21.2	2.003	5.084	1.923E+11
J	56	PARENT	L-C	R1	22"*12" VESSELET	250	28-Oct-85	231.0	528.8	2.540	20.8	2.012	5.083	1.828E+11
J	57	PARENT	L-C	R2	22"*12" VESSELET	250	30-Oct-85	231.0	528.8	2.542	21.5	1.995	5.080	1.828E+11
J	58	PARENT	L-C	R2	22"*12" VESSELET	250	31-Oct-85	231.0	528.8	2.540	21.1	2.005	5.081	1.828E+11
J	59	PARENT	C-L	M2	24" NPS Sch 100	250	07-Oct-85	268.3	525.5	3.180	20.0	2.544	6.362	1.828E+11
J	60	PARENT	C-L	M2	24" NPS Sch 100	250	08-Oct-85	268.3	525.5	3.177	20.0	2.541	6.365	1.828E+11
J	61	PARENT	C-L	S1	24" NPS Sch 100	250	09-Oct-85	268.3	525.5	3.175	19.7	2.551	6.366	1.828E+11
J	62	PARENT	C-L	N3	22" NPS Sch 100	20	10-Oct-85	324.0	529.5	3.160	19.0	2.560	6.370	1.923E+11
J	63	PARENT	C-L	N3	22" NPS Sch 100	20	11-Oct-85	324.0	529.5	3.150	18.2	2.576	6.360	1.923E+11
J	64	PARENT	C-L	N4	22" NPS Sch 100	20	15-Oct-85	324.0	529.5	3.175	19.5	2.555	6.360	1.923E+11
J	65	PARENT	C-L	N3	22" NPS Sch 100	250	16-Oct-85	224.0	506.1	3.160	18.9	2.563	6.360	1.828E+11
J	66	PARENT	C-L	N4	22" NPS Sch 100	250	16-Oct-85	224.0	506.1	3.176	19.8	2.546	6.358	1.828E+11
J	67	PARENT	C-L	N4	22" NPS Sch 100	250	17-Oct-85	224.0	506.1	3.177	20.1	2.540	6.367	1.828E+11
J	68	PARENT	C-L	P2	12" NPS Sch100	250	06-Jan-86	218.0	554.9	1.905	20.4	1.517	3.807	1.828E+11
J	69	PARENT	C-L	P3	12" NPS Sch100	250	03-Jan-86	218.0	554.9	1.906	20.6	1.513	3.812	1.828E+11
J	70	PARENT	C-L	P3	12" NPS Sch100	250	02-Jan-86	218.0	554.9	1.906	20.7	1.511	3.808	1.828E+11
J	71	PARENT	C-L	R3	22"*12" VESSELET	20	01-Nov-85	311.0	561.7	2.540	20.9	2.009	5.083	1.923E+11
J	72	PARENT	C-L	R3	22"*12" VESSELET	20	03-Nov-85	311.0	561.7	2.540	21.1	2.004	5.079	1.923E+11
J	73	PARENT	C-L	R4	22"*12" VESSELET	20	02-Nov-85	311.0	561.7	2.540	21.2	2.001	5.077	1.923E+11
J	74	PARENT	C-L	R3	22"*12" VESSELET	20	02-Nov-85	311.0	561.7	2.542	21.9	1.986	5.079	1.923E+11
J	75	PARENT	C-L	R4	22"*12" VESSELET	20	03-Nov-85	311.0	561.7	2.540	21.1	2.004	5.084	1.923E+11
J	76	PARENT	C-L	R4	22"*12" VESSELET	20	04-Nov-85	311.0	561.7	2.540	21.1	2.004	5.085	1.923E+11
J	77	PARENT	C-L	R5	22"*12" VESSELET	250	14-Apr-86	228.3	526.4	2.541	20.0	2.032	5.081	1.828E+11
J	78	PARENT	C-L	R5	22"*12" VESSELET	250	10-Apr-86	228.3	526.4	2.540	19.9	2.034	5.093	1.828E+11
J	79	PARENT	C-L	F6	22"*12" VESSELET	250	11-Apr-86	228.3	526.4	2.541	19.7	2.042	5.079	1.828E+11
J	80	WELD PN-232	L-C	B3	24" NPS Sch 100	20	07-Apr-86	309.0	512.0	2.539	20.2	2.026	5.082	1.923E+11
J	81	WELD PN-232	L-C	B6	24" NPS Sch 100	20	08-Apr-86	309.0	512.0	3.032	20.9	2.397	6.352	1.923E+11
J	82	WELD PN-232	L-C	B6	24" NPS Sch 100	20	09-Apr-86	309.0	512.0	2.541	20.3	2.024	5.081	1.923E+11
J	83	W PN229 SR	L-C	D5	22" NPS Sch 100	20	24-Feb-86	367.0	516.0	2.541	21.6	1.991	5.089	1.923E+11
J	84	W PN229 SR	L-C	D5	22" NPS Sch 100	250	25-Feb-86	364.0	553.1	2.539	21.1	2.003	5.090	1.828E+11
J	85	W PN229 SR	L-C	D6	22" NPS Sch 100	250	26-Feb-86	364.0	553.1	2.540	21.2	2.001	5.087	1.828E+11
TD	13	PARENT	C-L	M5	24" NPS Sch 100	200	15-Sep-85	248.5	482.0	3.177	20.3	2.531	6.365	1.864E+11
TD	14	PARENT	C-L	M5	24" NPS Sch 100	200	14-Sep-85	248.5	482.0	3.174	19.9	2.543	6.363	1.864E+11
TD	15	PARENT	C-L	M5	24" NPS Sch 100	250	13-Sep-85	228.0	510.8	3.175	19.7	2.551	6.360	1.828E+11
TD	16	PARENT	C-L	M2	24" NPS Sch 100	300	28-May-86	223.0	513.8	3.174	19.6	2.552	6.366	1.785E+11
TD	17	PARENT	C-L	M6	24" NPS Sch 100	300	11-Sep-85	223.0	513.8	3.175	20.0	2.541	6.359	1.785E+11
TD	18	PARENT	C-L	M6	24" NPS Sch 100	250	10-Sep-85	228.0	510.8	3.176	20.2	2.535	6.362	1.828E+11

TEST NO	FATIGUE CRACK MEASURED cm	FATIGUE CRACK COMPLIANCE cm	CRACK EXTENSION MEASURED cm	FINAL CRACK COMPLIANCE cm	CRACK EXTENSION COMPLIANCE cm	REMAINING LIGAMENT cm	Jic kN/m	SLOPE MPa	INTERCEPT kN/m	AV. T AT Jic	APPROX. w AT Jic
J 1	3.715	3.620	0.613	4.185	0.565	2.037	185	94	161	125.9	13.4
J 2	3.818	3.723	0.401	4.137	0.414	2.142	160	93	140	124.6	14.7
J 3	3.743	3.655	0.394	4.009	0.354	2.227	265	101	229	135.3	9.9
J 4	3.681	3.554	0.407	3.939	0.385	2.272	419	129	347	164.4	8.2
J 5	3.697	3.560	0.282	3.806	0.246	2.386	495	148	397	186.7	7.9
J 6	3.720	3.630	0.697	4.287	0.657	1.944	378	134	311	170.8	9.3
J 7	3.716	3.618	0.548	4.016	0.398	2.096	274	109	234	139.0	10.4
J 8	3.717	3.593	0.315	3.881	0.288	2.265	355	107	305	136.4	7.7
J 9	3.715	3.618	0.570	4.156	0.536	2.074	246	99	209	159.9	10.6
J 10	3.753	3.664	0.637	4.253	0.589	1.971	243	96	208	155.1	10.2
J 11	3.745	3.643	0.545	4.152	0.509	2.070	223	119	183	192.3	13.8
J 12	3.736	3.630	0.529	4.091	0.461	2.086	214	75	189	121.2	9.1
J 13	3.767	3.662	0.444	4.080	0.418	2.089	179	118	147	190.6	16.6
J 14	3.965	3.872	0.168	4.032	0.160	2.216	235	261	163	276.0	26.3
J 15	3.952	3.848	0.430	4.232	0.384	1.967	219	227	161	240.1	24.6
J 16	3.968	3.864	0.435	4.266	0.402	1.946	255	224	188	236.9	20.7
J 17	3.944	3.814	0.466	4.281	0.467	1.937	131	118	109	162.2	21.5
J 18	3.934	3.830	0.446	4.255	0.425	1.964	160	106	137	145.7	15.8
J 19	3.959	3.870	0.437	4.310	0.440	1.949	138	113	117	155.4	19.4
J 20	3.103	2.985	0.189	3.157	0.172	1.803	281	327	178	314.2	22.9
J 21	3.064	2.966	0.359	3.328	0.362	1.667	281	240	205	230.6	17.1
J 22	3.034	2.928	0.366	3.277	0.349	1.694	335	241	244	231.5	14.7
J 23	3.015	2.940	0.552	3.483	0.543	1.525	134	89	121	81.1	13.7
J 24	3.090	3.020	0.623	3.652	0.632	1.378	110	72	101	65.6	13.0
J 25	3.037	2.924	0.564	3.515	0.591	1.489	135	87	122	79.2	13.1
J 26	3.013	2.925	0.273	3.202	0.277	1.796	421	201	326	193.1	9.8
J 27	3.022	2.942	0.353	3.287	0.345	1.707	385	235	283	225.8	12.5
J 28	3.111	3.025	0.425	3.395	0.370	1.548	187	82	170	74.7	8.6
J 29	3.047	2.970	0.455	3.387	0.417	1.582	196	85	178	77.4	8.7
J 30	3.130	3.036	0.207	3.796	0.760	1.758	175	188	137	185.5	20.9
J 31	3.100	3.021	0.216	3.217	0.196	1.775	172	185	136	182.5	21.2
J 32	3.191	3.107	0.260	3.833	0.726	1.644	178	155	147	152.9	16.4
J 33	3.039	2.963	0.476	3.447	0.484	1.578	86	59	80	51.3	14.0
J 34	3.201	3.106	0.488	3.627	0.521	1.402	63	62	58	53.9	18.4
J 35	3.227	3.126	0.495	3.646	0.520	1.371	74	63	69	54.8	15.7
J 36	3.215	3.123	0.385	3.549	0.375	1.484	214	231	158	227.9	20.0
J 37	3.228	3.132	0.246	3.344	0.212	1.609	275	236	201	232.8	15.7
J 38	3.221	3.148	0.534	3.661	0.513	1.327	113	98	101	85.1	16.0
J 39	3.063	3.006	0.568	3.547	0.541	1.454	101	106	89	92.0	21.0
J 40	3.035	2.952	0.420	3.343	0.391	1.636	346	137	283	176.7	8.1
J 41	3.237	3.194	0.508	3.660	0.466	1.346	236	111	201	143.2	8.6
J 42	3.423	3.364	0.312	3.633	0.269	1.358	323	141	262	181.9	7.2
J 43	3.217	3.117	0.355	3.428	0.311	1.511	189	156	150	201.3	15.2
J 44	3.156	3.074	0.333	3.357	0.283	1.593	361	115	306	148.4	6.1
J 45	2.309	2.226	0.384	2.601	0.375	1.117	131	114	106	122.0	12.9
J 46	2.304	2.227	0.412	2.627	0.400	1.093	158	98	139	104.9	9.2

TEST NO	FATIGUE CRACK MEASURED cm	FATIGUE CRACK COMPLIANCE cm	CRACK EXTENSION MEASURED cm	FINAL CRACK COMPLIANCE cm	CRACK EXTENSION COMPLIANCE cm	REMAINING LIGAMENT cm	Jic kN/m	SLOPE MPa	INTERCEPT kN/m	AV. T AT Jic	APPROX. w AT Jic
J 47	2.307	2.222	0.377	2.614	0.392	1.125	112	112	96	119.8	14.8
J 48	2.386	2.320	0.342	2.680	0.360	1.062	104	78	95	75.0	10.5
J 49	2.279	2.204	0.366	2.579	0.375	1.164	121	79	110	75.9	9.9
J 50	2.317	2.239	0.368	2.590	0.351	1.123	95	104	84	99.9	16.1
J 51	2.449	2.400	0.357	2.750	0.350	0.998	88	98	78	94.2	14.9
J 52	2.306	2.250	0.311	2.538	0.288	1.196	191	136	161	130.7	10.6
J 53	3.146	3.047	0.420	3.473	0.426	1.513	133	192	104	189.3	27.6
J 54	3.193	3.090	0.358	3.434	0.344	1.532	140	204	107	201.2	27.2
J 55	3.179	3.091	0.325	3.413	0.322	1.580	174	179	138	176.5	19.4
J 56	3.181	3.087	0.538	3.584	0.497	1.364	139	69	127	87.4	9.3
J 57	3.158	3.094	0.504	3.547	0.453	1.418	131	111	111	140.6	16.1
J 58	3.156	3.067	0.460	3.505	0.438	1.465	150	103	130	130.4	13.1
J 59	3.701	3.627	0.563	4.173	0.546	2.098	81	53	76	61.5	17.3
J 60	3.729	3.643	0.684	4.309	0.666	1.952	108	43	102	49.9	10.4
J 61	3.898	3.805	0.612	4.417	0.612	1.856	100	59	93	66.5	14.4
J 62	3.934	3.845	0.604	4.424	0.579	1.832	111	75	102	79.2	16.3
J 63	3.688	3.606	0.595	4.172	0.566	2.077	190	58	177	61.3	8.1
J 64	3.832	3.723	0.556	4.268	0.545	1.972	71	105	63	110.9	37.1
J 65	3.730	3.637	0.553	4.140	0.503	2.077	111	34	105	46.6	8.0
J 66	3.759	3.674	0.652	4.302	0.628	1.947	94	38	89	52.1	10.4
J 67	3.743	3.649	0.679	4.312	0.663	1.945	86	52	80	71.3	15.7
J 68	2.345	2.283	0.392	2.660	0.377	1.070	102	71	93	86.9	10.0
J 69	2.292	2.225	0.356	2.574	0.349	1.164	147	90	136	110.1	9.2
J 70	2.317	2.237	0.357	2.603	0.366	1.134	133	85	118	104.0	9.4
J 71	3.159	3.099	0.467	3.513	0.414	1.457	110	93	98	93.9	16.1
J 72	3.122	3.058	0.538	3.573	0.515	1.419	104	113	91	114.2	21.0
J 73	3.139	3.078	0.466	3.506	0.428	1.472	104	90	93	90.9	16.6
J 74	3.192	3.126	0.477	3.580	0.454	1.410	97	97	86	98.0	18.7
J 75	3.192	3.122	0.610	3.730	0.608	1.282	89	77	81	77.8	16.2
J 76	3.158	3.087	0.599	3.650	0.563	1.328	88	80	80	80.8	17.3
J 77	3.079	2.989	0.419	3.366	0.377	1.583	74	69	67	88.6	18.5
J 78	3.079	3.024	0.506	3.498	0.474	1.508	81	51	76	65.5	12.6
J 79	3.059	2.966	0.697	3.592	0.626	1.323	96	42	90	53.9	8.7
J 80	3.109	2.997	0.414	3.387	0.390	1.559	267	220	195	251.1	16.1
J 81	3.802	3.671	0.408	4.034	0.363	2.142	302	237	215	270.5	19.9
J 82	3.099	2.984	0.335	3.292	0.308	1.647	389	266	263	303.6	13.4
J 83	3.093	3.026	0.176	3.195	0.169	1.820	240	256	170	252.6	21.1
J 84	3.079	2.992	0.361	3.358	0.366	1.650	162	138	138	120.0	17.0
J 85	3.088	3.004	0.359	3.334	0.330	1.640	132	142	112	123.4	21.3
TD 13	3.742	3.658	0.891	4.527	0.869	1.732	113	47	105	65.7	10.8
TD 14	3.791	3.679	0.898	4.577	0.898	1.674	100	50	93	69.8	12.8
TD 15	3.728	3.609	0.468	4.053	0.444	2.164	98	37	93	49.6	9.9
TD 16	3.702	3.581	0.572	4.134	0.553	2.092	106	49	99	64.5	12.2
TD 17	3.731	3.618	0.614	4.248	0.630	2.014	104	46	98	60.5	11.5
TD 18	3.709	3.599	0.702	4.310	0.711	1.951	79	62	72	83.0	20.7

YES = ++++++ ; NO = .
(1) Bn > 25Jic/FLOW STRESS
(2) LIGAMENT > 25Jic/FLOW STRESS
(3) DJ/DA < FLOW STRESS

(4) Bn*FLOW STRESS /20
(5) LIGAMENT*FLOW STRESS /20
(6) ABS(Lm-Lc) < 0.15* CRACK EXTENSION
(7) 0.1* ORIGINAL LIGAMENT

QUALIFICATION OF R-CURVE DATA

J IN kN/m, DA IN mm
CURVE FIT TO THE FORM J=C1*(da)^C2

	TEST NO	VALIDITY (1)	Jic VALIDITY (2)	VALIDITY (3)	25*Jic/F.S. cm	CRACK EXTENSION ALLOWED (7) cm	J(MAX) ALLOWED (4) kN/m	J(MAX) ALLOWED (5) kN/m	CRACK SIZE VALIDITY (6)	FIRST POINT	LAST POINT	CONSTANT C1	EXPONENT C2
J	1	++++++	++++++	++++++	1.252	0.275	470.4	402.6	++++++	19	36	259.280	0.4025
J	2	++++++	++++++	++++++	1.083	0.264	470.4	410.8	++++++	17	31	242.430	0.4292
J	3	++++++	++++++	++++++	1.793	0.271	471.4	435.0	++++++	22	34	336.520	0.3387
J	4	.	.	++++++	2.766	0.281	454.4	456.4	++++++	31	43	482.700	0.2979
J	5	.	.	++++++	3.268	0.281	454.4	464.5	++++++	34	44	544.580	0.3582
J	6	.	.	++++++	2.496	0.273	456.1	392.7	++++++	22	41	450.010	0.3831
J	7	++++++	++++++	++++++	1.809	0.274	454.4	443.8	.	22	32	347.440	0.3047
J	8	.	.	++++++	2.344	0.270	432.5	457.4	++++++	25	33	408.320	0.3654
J	9	++++++	++++++	++++++	1.828	0.274	404.1	370.5	++++++	18	34	309.700	0.4183
J	10	++++++	++++++	++++++	1.806	0.270	405.3	354.5	++++++	19	35	298.680	0.4382
J	11	++++++	++++++	++++++	1.657	0.272	403.3	371.3	++++++	17	34	309.720	0.4398
J	12	++++++	++++++	++++++	1.591	0.272	406.6	380.1	++++++	19	32	266.410	0.3938
J	13	++++++	++++++	++++++	1.330	0.264	409.3	373.3	++++++	18	32	269.190	0.3991
J	14	++++++	++++++	++++++	1.378	0.248	524.1	494.0	++++++	18	26	429.650	0.6130
J	15	++++++	++++++	++++++	1.284	0.250	524.8	451.4	++++++	17	44	400.400	0.6575
J	16	++++++	++++++	++++++	1.495	0.249	524.8	444.1	++++++	19	43	419.940	0.5806
J	17	++++++	++++++	++++++	0.898	0.253	448.5	376.6	++++++	12	28	232.330	0.4819
J	18	++++++	++++++	++++++	1.097	0.251	448.3	380.8	++++++	14	28	250.200	0.4432
J	19	++++++	++++++	++++++	0.946	0.247	447.6	371.0	++++++	13	28	235.480	0.4554
J	20	++++++	++++++	++++++	1.570	0.211	454.2	433.6	++++++	21	32	511.490	0.6540
J	21	++++++	++++++	++++++	1.570	0.212	446.3	394.2	++++++	16	34	452.450	0.5991
J	22	++++++	.	++++++	1.872	0.217	449.2	406.3	++++++	17	34	490.080	0.5476
J	23	++++++	++++++	++++++	0.746	0.215	450.7	360.4	++++++	13	25	219.640	0.4056
J	24	++++++	++++++	++++++	0.614	0.207	451.4	322.3	++++++	12	24	180.000	0.4152
J	25	++++++	++++++	++++++	0.753	0.217	452.5	352.8	++++++	13	25	216.800	0.3831
J	26	.	.	++++++	2.352	0.216	448.6	420.6	++++++	19	30	527.560	0.4569
J	27	.	.	++++++	2.151	0.214	451.3	401.6	++++++	19	34	521.420	0.5036
J	28	++++++	++++++	++++++	1.044	0.206	449.4	378.3	++++++	15	24	258.450	0.3283
J	29	++++++	++++++	++++++	1.094	0.211	449.6	380.1	++++++	15	26	271.000	0.3463
J	30	++++++	++++++	++++++	0.991	0.206	444.0	286.8	.	15	25	333.030	0.5903
J	31	++++++	++++++	++++++	0.974	0.207	445.8	413.7	++++++	15	25	328.230	0.5830
J	32	++++++	++++++	++++++	1.008	0.199	444.2	278.6	.	14	26	310.800	0.5352
J	33	++++++	++++++	++++++	0.469	0.213	461.8	377.4	++++++	9	16	147.000	0.4018
J	34	++++++	++++++	++++++	0.343	0.199	463.1	335.7	++++++	9	19	126.060	0.4397
J	35	++++++	++++++	++++++	0.403	0.197	463.6	331.8	++++++	9	19	135.370	0.4226
J	36	++++++	++++++	++++++	1.212	0.196	442.2	339.0	++++++	14	33	397.580	0.5665
J	37	++++++	++++++	++++++	1.557	0.195	440.7	383.9	++++++	16	33	450.310	0.5830
J	38	++++++	++++++	++++++	0.616	0.193	458.0	326.0	++++++	11	27	204.710	0.4554
J	39	++++++	++++++	++++++	0.550	0.208	460.9	352.9	++++++	11	23	190.140	0.3753
J	40	.	.	++++++	2.298	0.214	376.8	329.0	++++++	18	29	426.660	0.3462
J	41	++++++	.	++++++	1.567	0.190	377.2	269.3	++++++	14	29	319.130	0.3886
J	42	.	.	++++++	2.145	0.173	376.6	274.8	++++++	18	29	408.320	0.3968
J	43	++++++	++++++	++++++	1.255	0.197	376.8	311.5	++++++	15	33	318.030	0.5294
J	44	.	.	++++++	2.398	0.201	380.8	324.6	.	23	33	424.150	0.3301
J	45	++++++	++++++	++++++	0.792	0.158	314.3	249.8	++++++	12	26	227.200	0.4703
J	46	++++++	++++++	++++++	0.956	0.158	311.0	244.3	++++++	13	28	247.040	0.4010

YES = ++++++ ; NO = .
(1) Bn > 25Jic/FLOW STRESS
(2) LIGAMENT > 25Jic/FLOW STRESS
(3) DJ/DA < FLOW STRESS
(4) Bn*FLOW STRESS /20
(5) LIGAMENT*FLOW STRESS /20
(6) ABS(Lm-Lc) < 0.15* CRACK EXTENSION
(7) 0.1* ORIGINAL LIGAMENT

QUALIFICATION OF R-CURVE DATA

J IN kN/m, DA IN mm
CURVE FIT TO THE FORM J=C1*(da)^C2

	TEST NO	VALIDITY (1)	Jic VALIDITY (2)	VALIDITY (3)	25*Jic/F.S. cm	CRACK EXTENSION ALLOWED (7) cm	J(MAX) ALLOWED (4) kN/m	J(MAX) ALLOWED (5) kN/m	CRACK SIZE VALIDITY (6)	FIRST POINT	LAST POINT	CONSTANT C1	EXPONENT C2
J	47	++++++	++++++	++++++	0.677	0.159	314.1	246.9	++++++	11	25	212.390	0.4507
J	48	++++++	++++++	++++++	0.596	0.149	274.6	246.4	++++++	7	16	179.360	0.4280
J	49	++++++	++++++	++++++	0.694	0.161	284.1	268.2	++++++	11	19	194.360	0.3720
J	50	++++++	++++++	++++++	0.545	0.157	288.1	265.6	++++++	10	20	191.950	0.4730
J	51	++++++	++++++	++++++	0.504	0.140	290.7	229.8	++++++	9	20	181.630	0.4862
J	52	++++++	++++++	++++++	1.095	0.156	289.6	278.0	++++++	14	27	307.030	0.4739
J	53	++++++	++++++	++++++	0.753	0.203	442.8	354.6	++++++	12	31	301.100	0.5934
J	54	++++++	++++++	++++++	0.792	0.199	439.7	364.1	++++++	11	30	316.070	0.6381
J	55	++++++	++++++	++++++	0.985	0.199	442.3	369.0	++++++	12	30	327.420	0.5957
J	56	++++++	++++++	++++++	0.915	0.200	382.2	284.7	++++++	14	29	200.500	0.4308
J	57	++++++	++++++	++++++	0.862	0.199	379.0	291.2	++++++	12	30	228.220	0.4299
J	58	++++++	++++++	++++++	0.987	0.201	380.9	299.4	++++++	15	30	237.190	0.4283
J	59	++++++	++++++	++++++	0.510	0.274	504.9	434.4	++++++	13	21	130.580	0.3527
J	60	++++++	++++++	++++++	0.680	0.272	504.3	408.0	++++++	15	26	152.670	0.2956
J	61	++++++	++++++	++++++	0.630	0.256	506.2	386.8	++++++	15	28	156.360	0.3465
J	62	++++++	++++++	++++++	0.650	0.253	546.3	415.2	++++++	13	30	188.320	0.4485
J	63	++++++	++++++	++++++	1.113	0.275	549.7	466.9	++++++	16	30	253.770	0.3032
J	64	++++++	++++++	++++++	0.416	0.264	545.2	446.4	++++++	11	29	174.760	0.5418
J	65	++++++	++++++	++++++	0.760	0.272	467.8	405.2	++++++	16	24	142.400	0.3038
J	66	++++++	++++++	++++++	0.644	0.268	464.7	375.3	++++++	15	24	131.470	0.3078
J	67	++++++	++++++	++++++	0.589	0.272	463.6	375.1	++++++	14	25	134.660	0.3269
J	68	++++++	++++++	++++++	0.660	0.152	293.1	221.6	++++++	10	21	169.070	0.3877
J	69	++++++	++++++	++++++	0.951	0.159	292.4	239.2	++++++	14	24	224.250	0.3567
J	70	++++++	++++++	++++++	0.860	0.157	292.0	232.8	++++++	13	25	209.540	0.4340
J	71	++++++	++++++	++++++	0.630	0.198	438.3	342.5	++++++	11	25	198.790	0.4529
J	72	++++++	++++++	++++++	0.596	0.202	437.2	328.6	++++++	11	27	204.200	0.4405
J	73	++++++	++++++	++++++	0.596	0.200	436.6	342.8	++++++	10	23	187.410	0.4006
J	74	++++++	++++++	++++++	0.556	0.195	433.3	327.0	++++++	10	24	187.840	0.4592
J	75	++++++	++++++	++++++	0.510	0.196	437.2	295.4	++++++	10	28	163.830	0.4762
J	76	++++++	++++++	++++++	0.504	0.200	437.2	313.1	++++++	10	25	162.760	0.4575
J	77	++++++	++++++	++++++	0.490	0.209	383.4	323.6	++++++	9	17	132.970	0.3435
J	78	++++++	++++++	++++++	0.537	0.207	383.8	300.9	++++++	11	22	130.800	0.3595
J	79	++++++	++++++	++++++	0.636	0.211	385.2	280.6	++++++	12	23	137.960	0.2881
J	80	++++++	.	++++++	1.626	0.209	415.9	347.9	++++++	19	45	423.800	0.5837
J	81	++++++	++++++	++++++	1.839	0.268	492.0	475.8	++++++	21	42	455.770	0.6135
J	82	.	.	++++++	2.369	0.210	415.4	367.2	++++++	23	45	526.780	0.6024
J	83	++++++	++++++	++++++	1.359	0.206	439.5	418.1	++++++	19	32	433.930	0.5969
J	84	++++++	++++++	++++++	0.883	0.210	459.3	397.1	++++++	14	31	283.000	0.4601
J	85	++++++	++++++	++++++	0.720	0.208	458.6	401.9	++++++	11	31	266.940	0.5390
TD	13	++++++	++++++	++++++	0.773	0.271	462.2	335.7	++++++	7	16	167.800	0.3487
TD	14	++++++	++++++	++++++	0.684	0.268	464.4	326.2	++++++	13	29	152.790	0.3752
TD	15	++++++	++++++	++++++	0.663	0.275	471.2	426.1	++++++	14	22	133.850	0.3650
TD	16	++++++	++++++	++++++	0.719	0.278	470.1	411.1	++++++	14	22	154.050	0.2854
TD	17	++++++	++++++	++++++	0.706	0.274	468.0	388.8	++++++	13	25	154.010	0.3507
TD	18	++++++	++++++	++++++	0.535	0.276	468.2	379.0	++++++	11	24	140.310	0.3425

APPENDIX C

Fracture Surfaces from All Tests

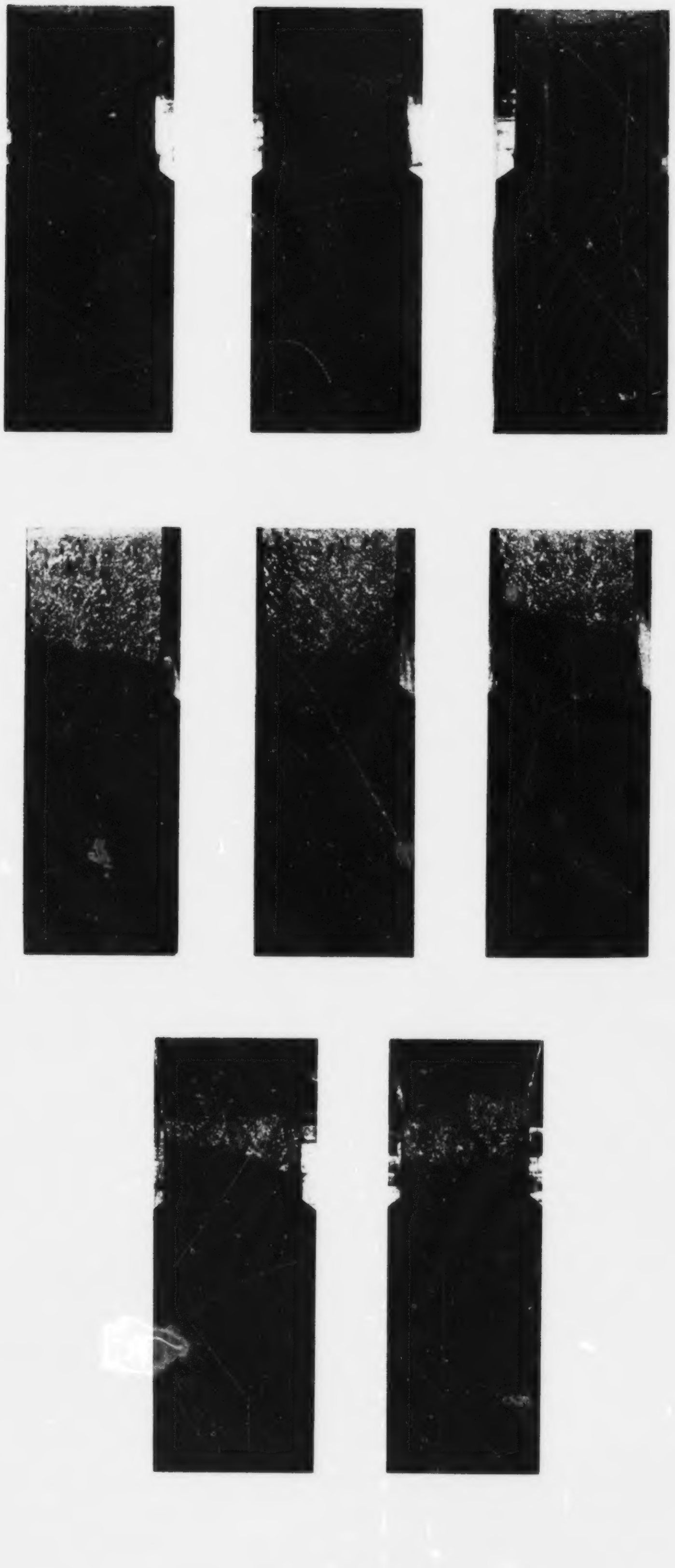


FIGURE C1

FRACTURE SURFACES SPECIMEN# J1 TO J8

172707-RD

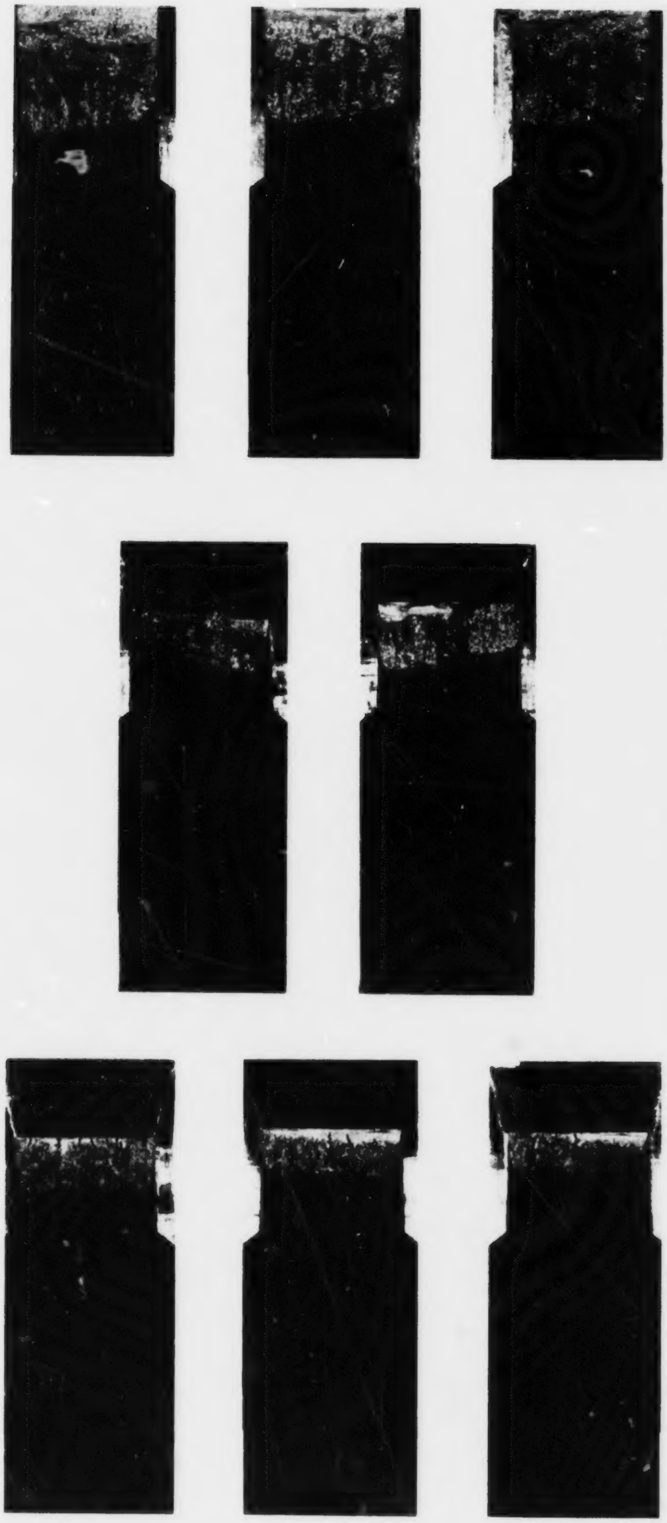


FIGURE C2
FRACTURE SURFACES SPECIMEN# J9 TO J16

172708-RD

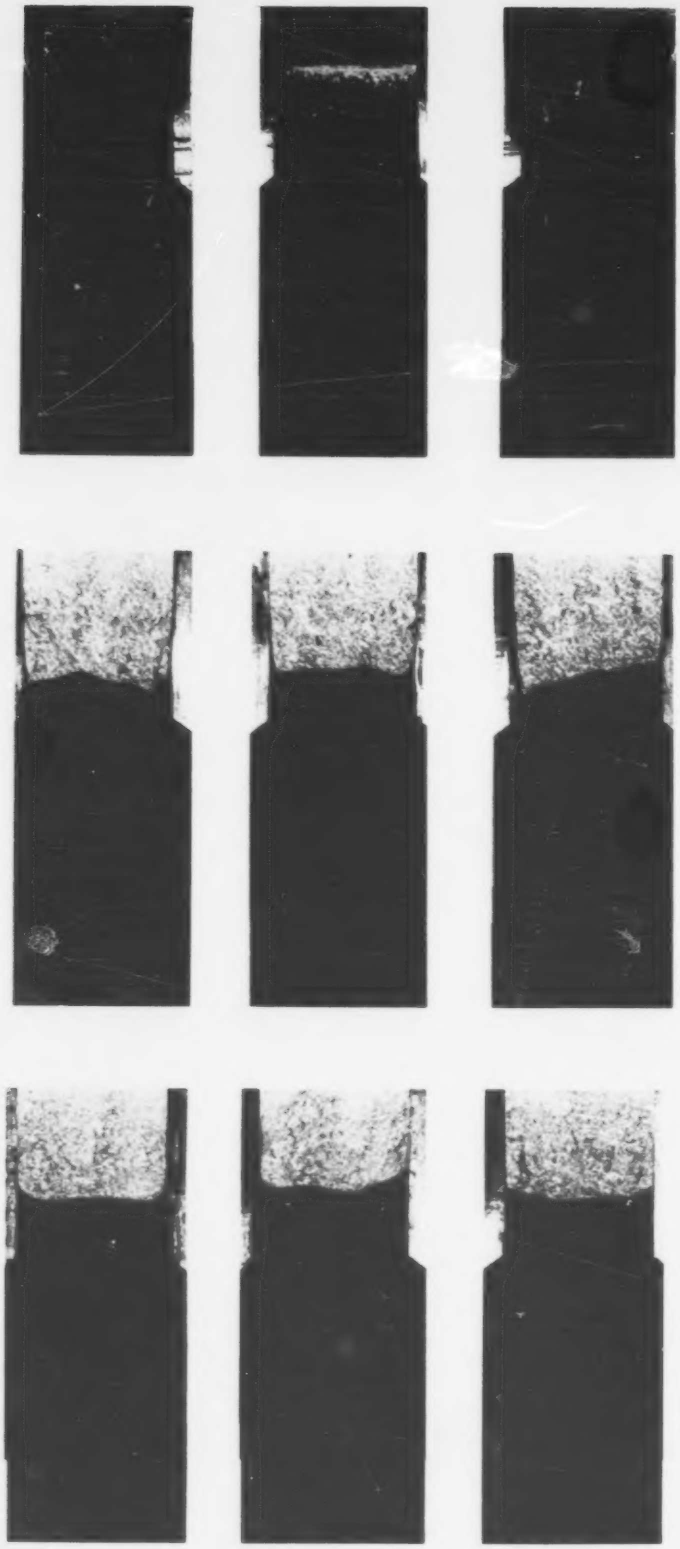


FIGURE C3

FRACTURE SURFACES SPECIMEN# J17 TO J25

172709-RD

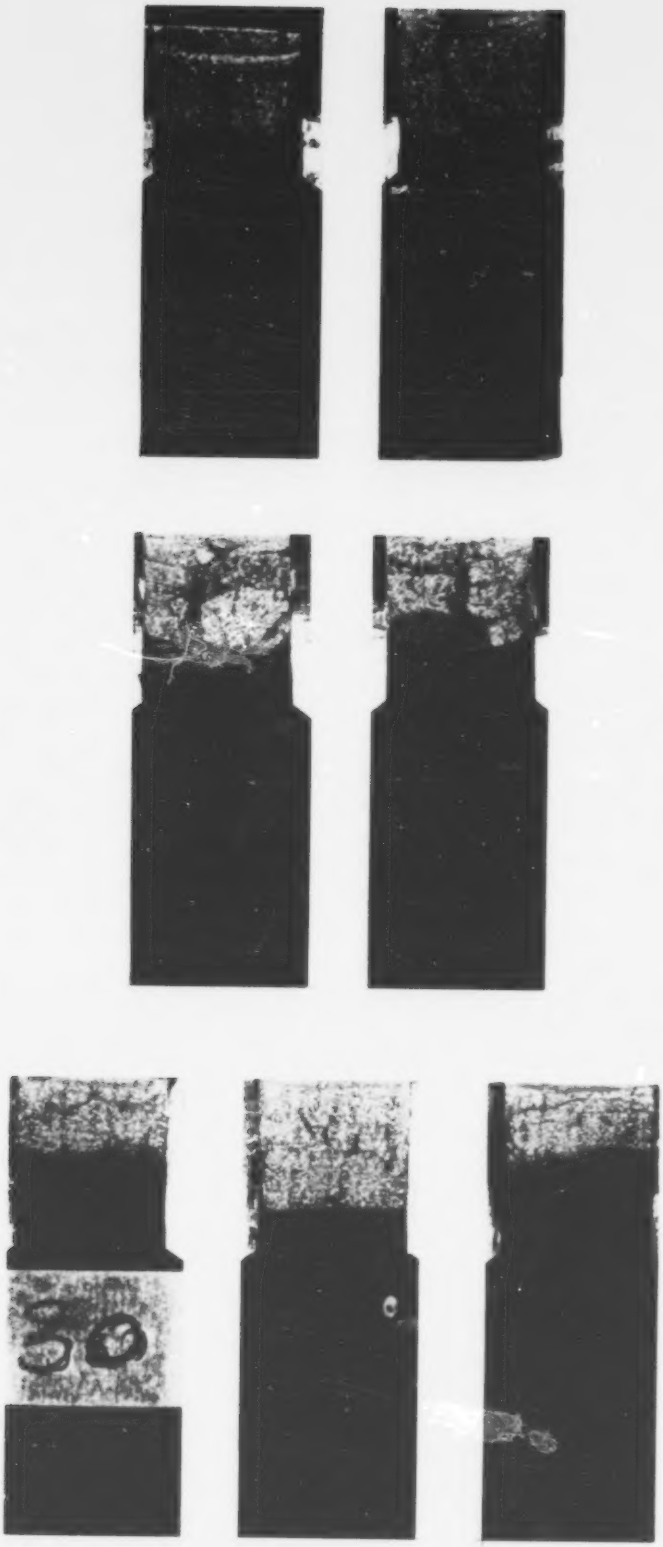


FIGURE C4

FRACTURE SURFACES SPECIMEN# J26 TO J32

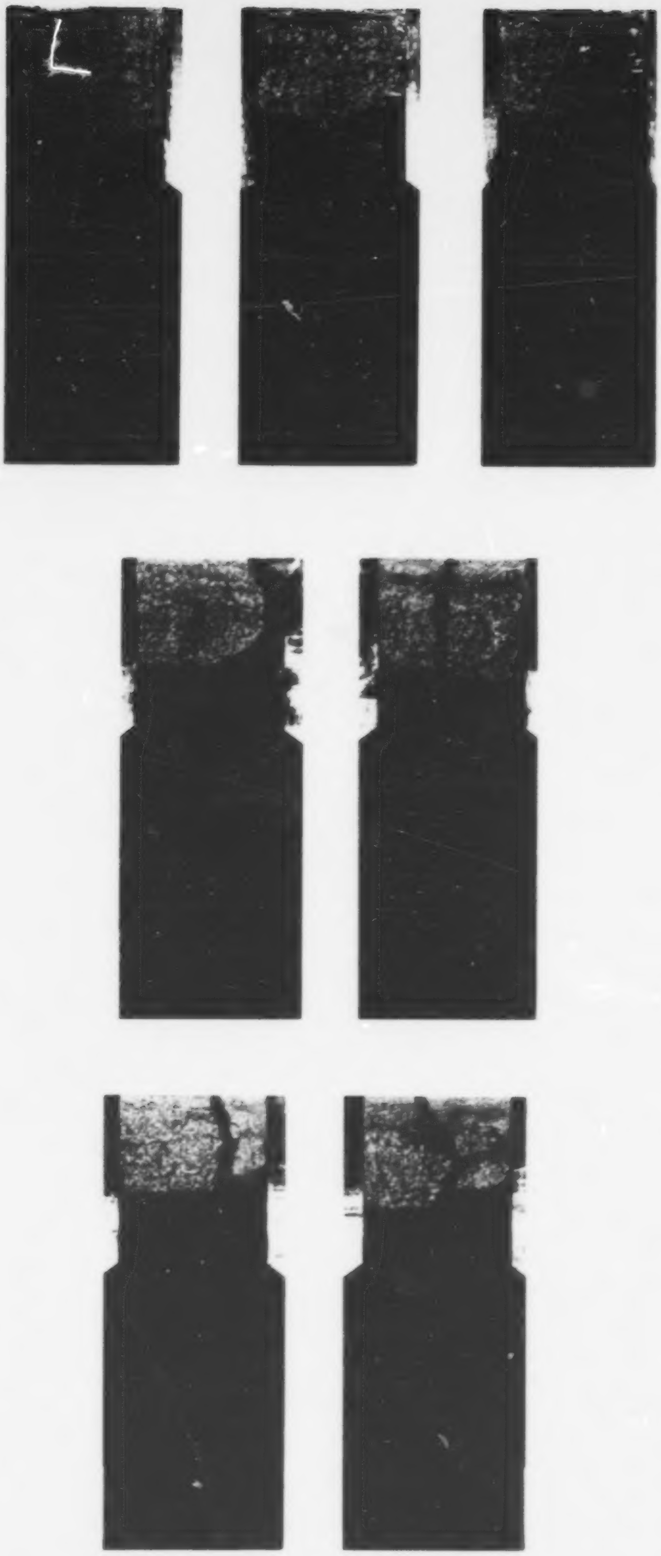


FIGURE C5

FRACTURE SURFACES SPECIMEN# J33 TO J39

172711-RD

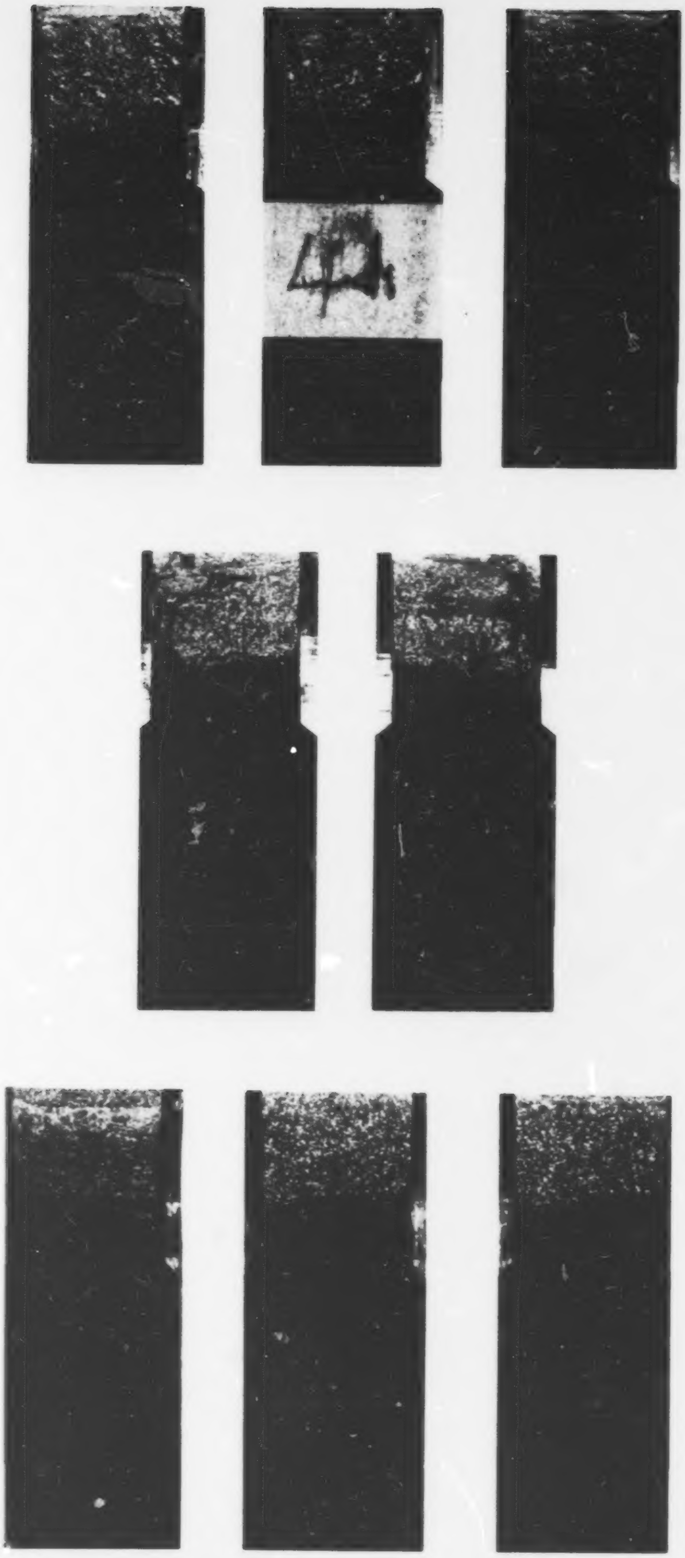


FIGURE C6
FRACTURE SURFACES SPECIMEN# J40 TO J47

172712-RD

FIGURE C7

FRACTURE SURFACES SPECIMEN# J48 TO J55

172713-RD

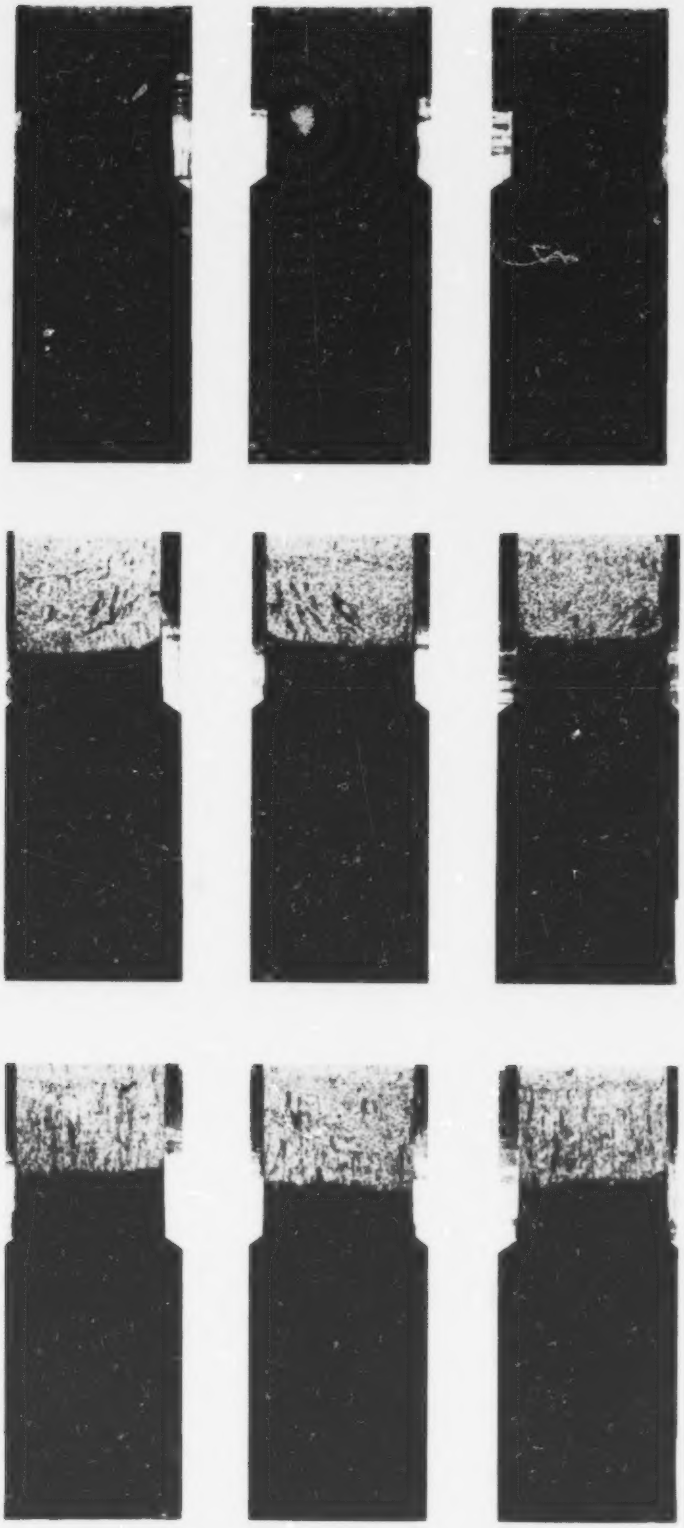


FIGURE C8

FRACTURE SURFACES SPECIMEN# J56 TO J64

172714-RD

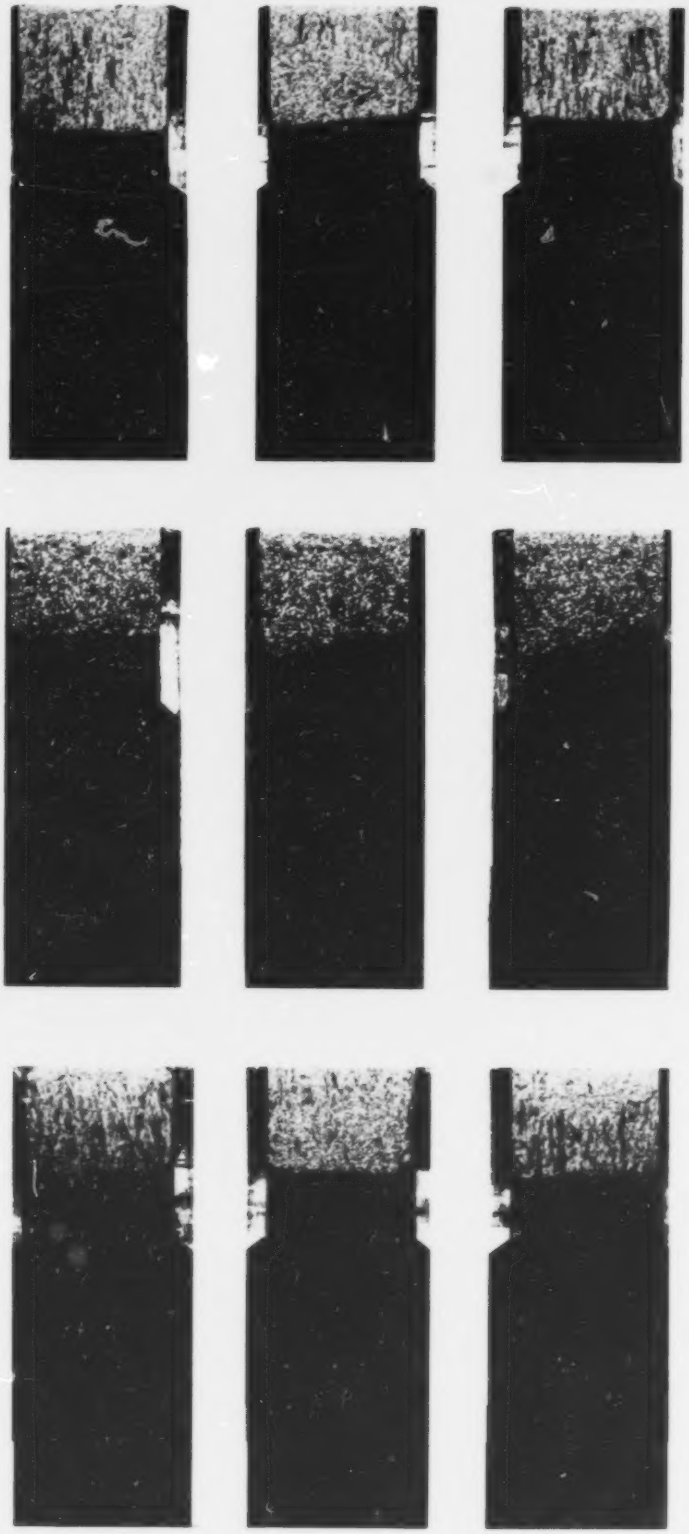


FIGURE C9

FRACTURE SURFACES SPECIMEN# J65 TO J73

172715-RD

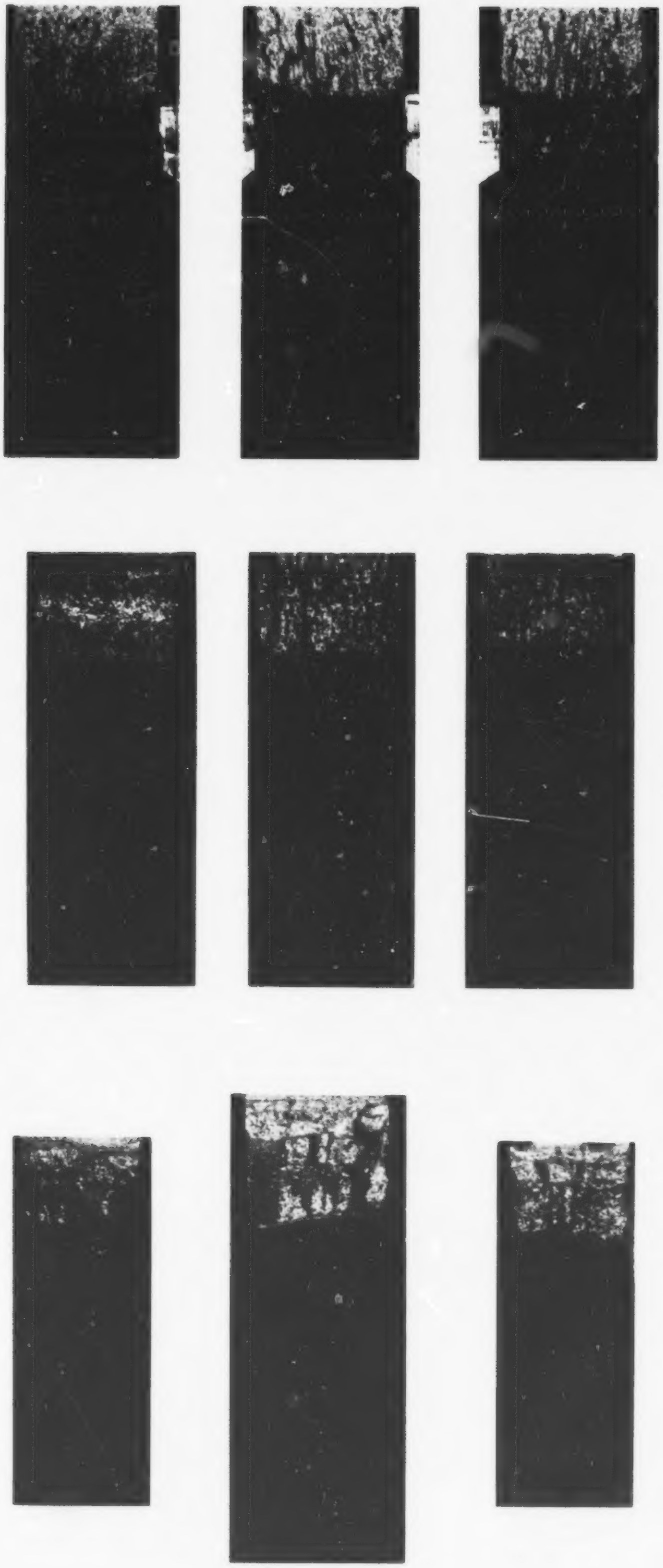


FIGURE C10

FRACTURE SURFACES SPECIMEN# J74 TO J82

172716-RD

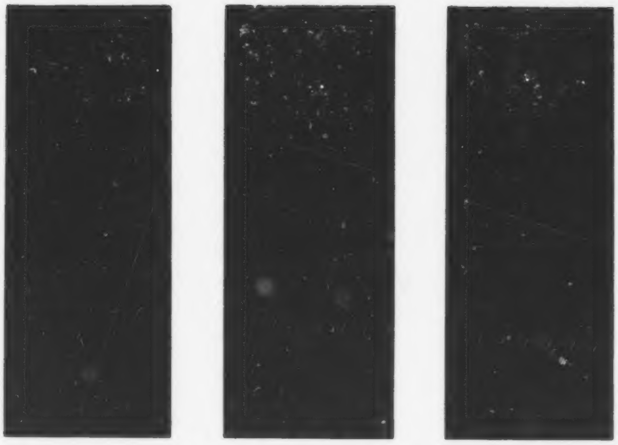


FIGURE C11
FRACTURE SURFACES SPECIMEN# J83 TO J85

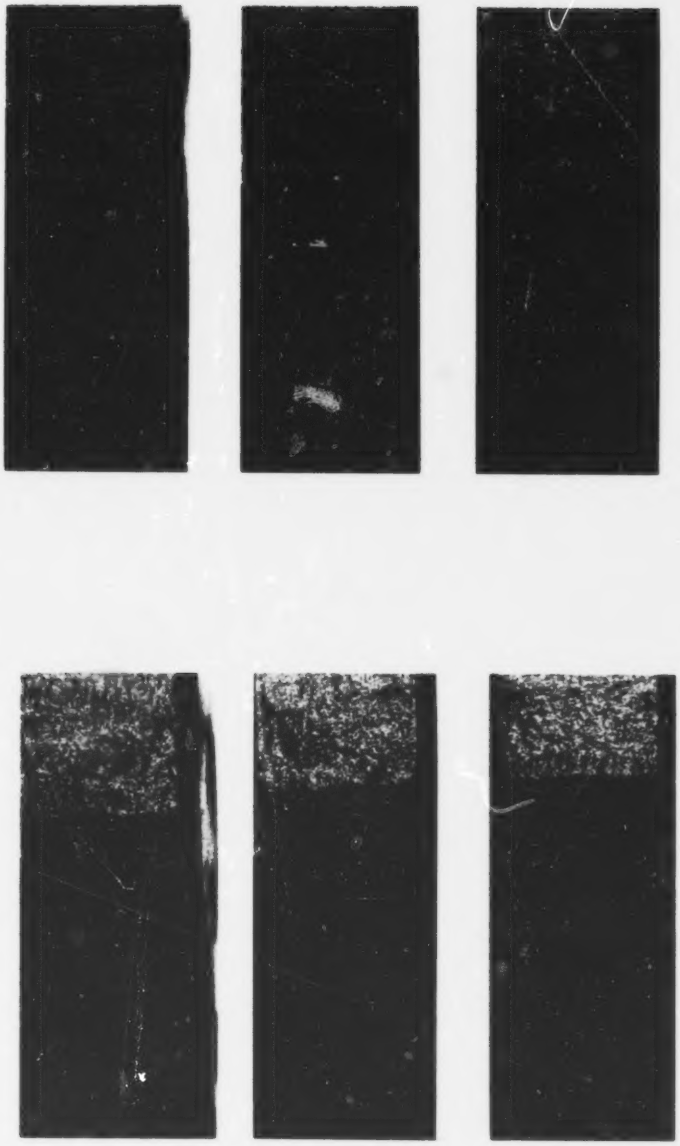


FIGURE C12

FRACTURE SURFACES SPECIMEN# TD13 TO TD18

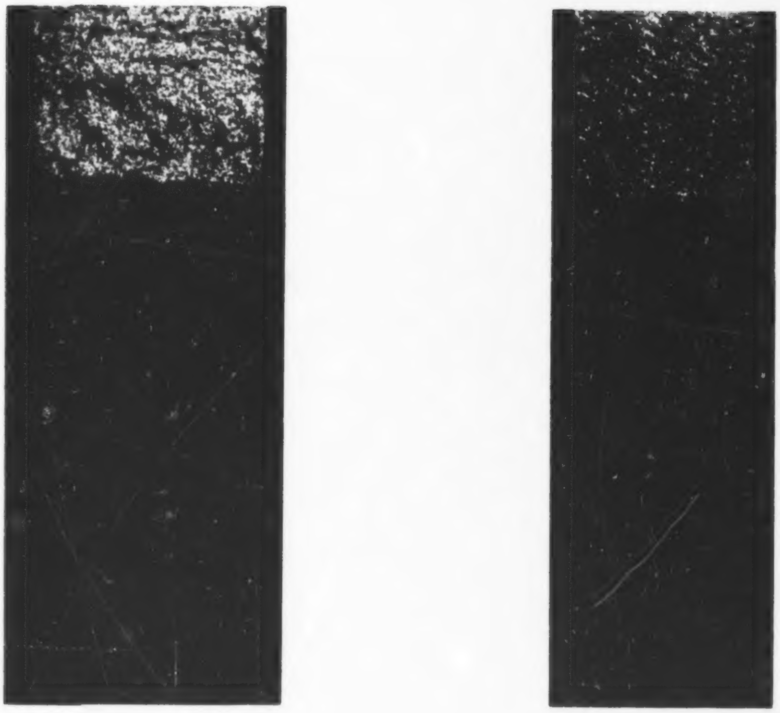
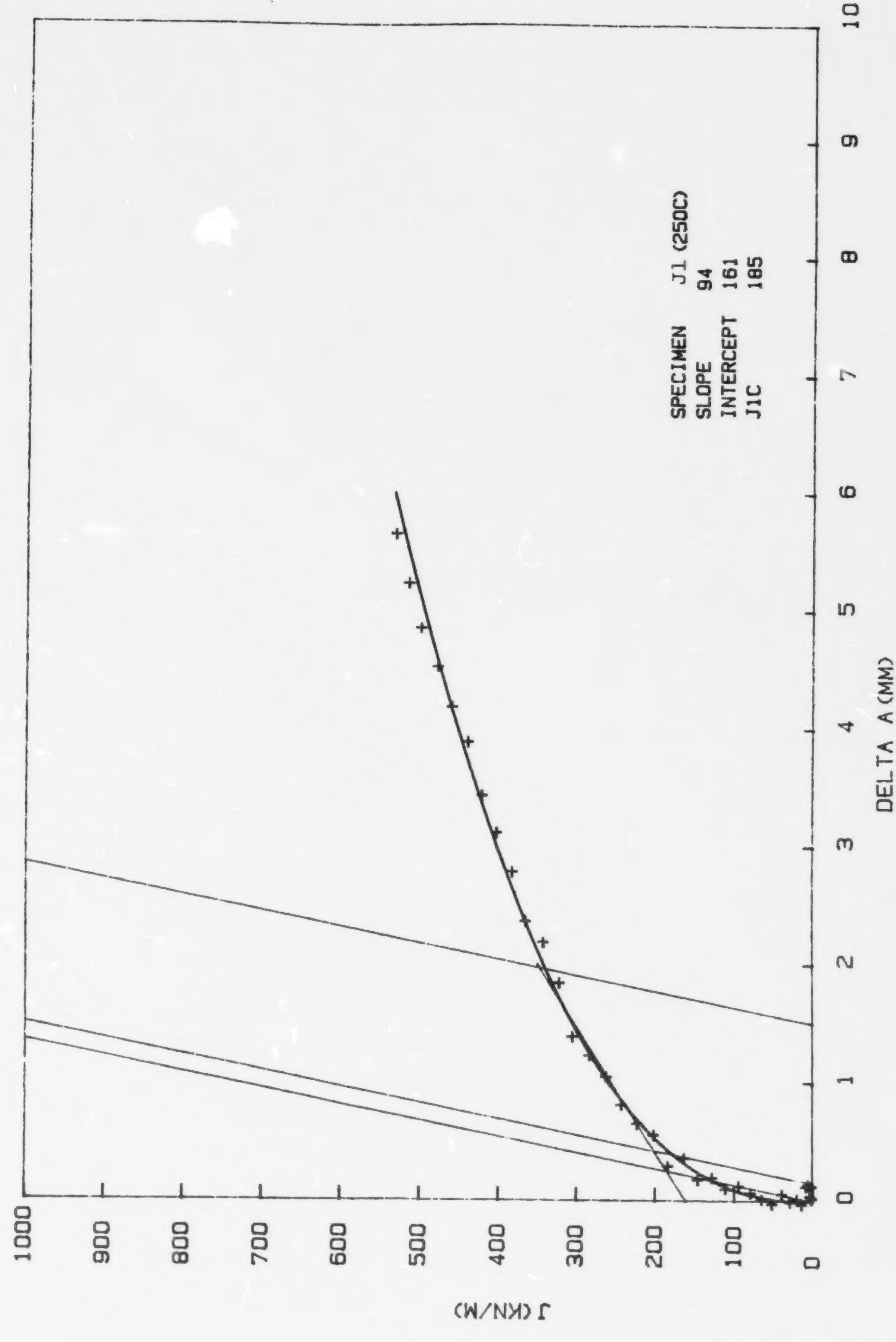


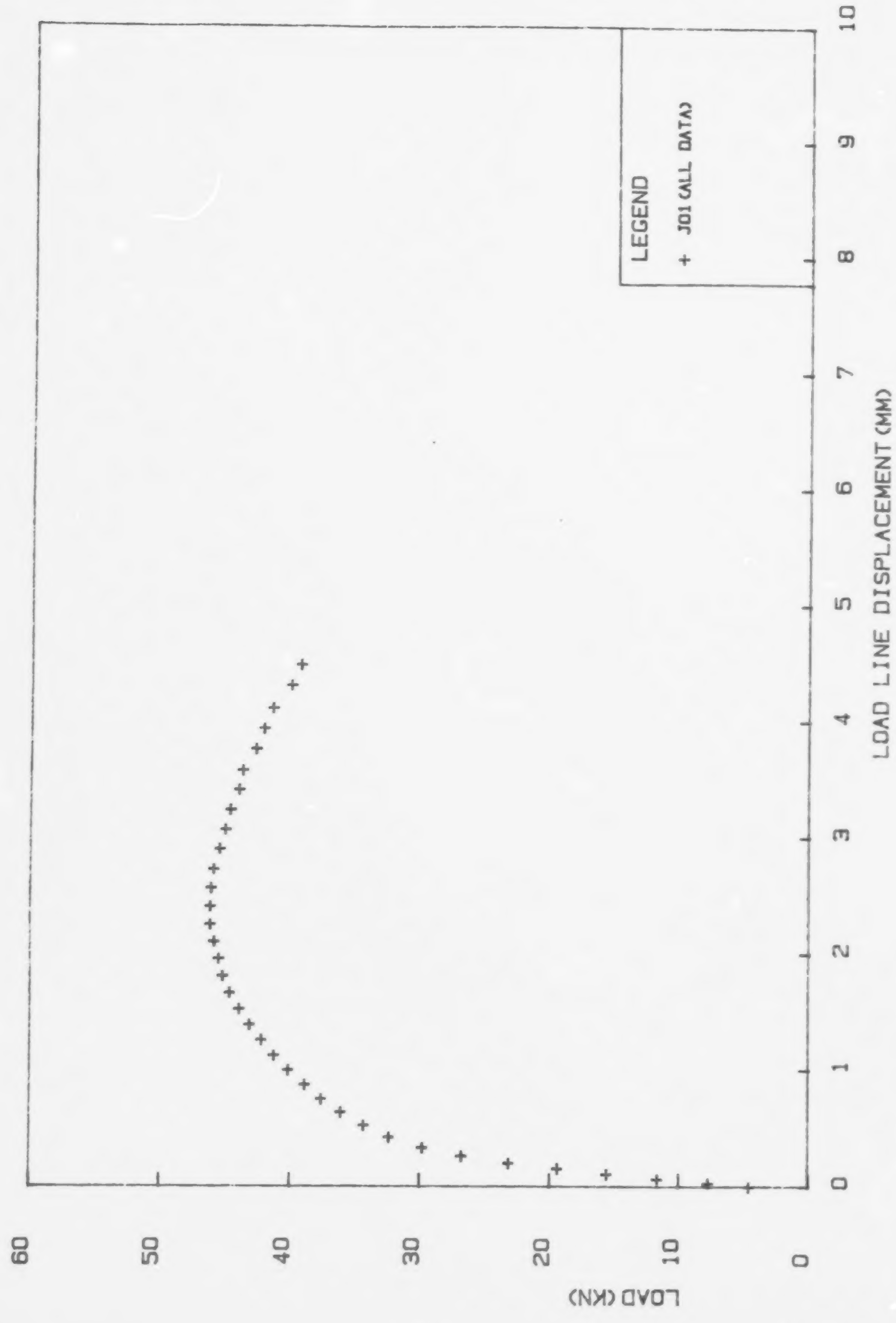
FIGURE C13

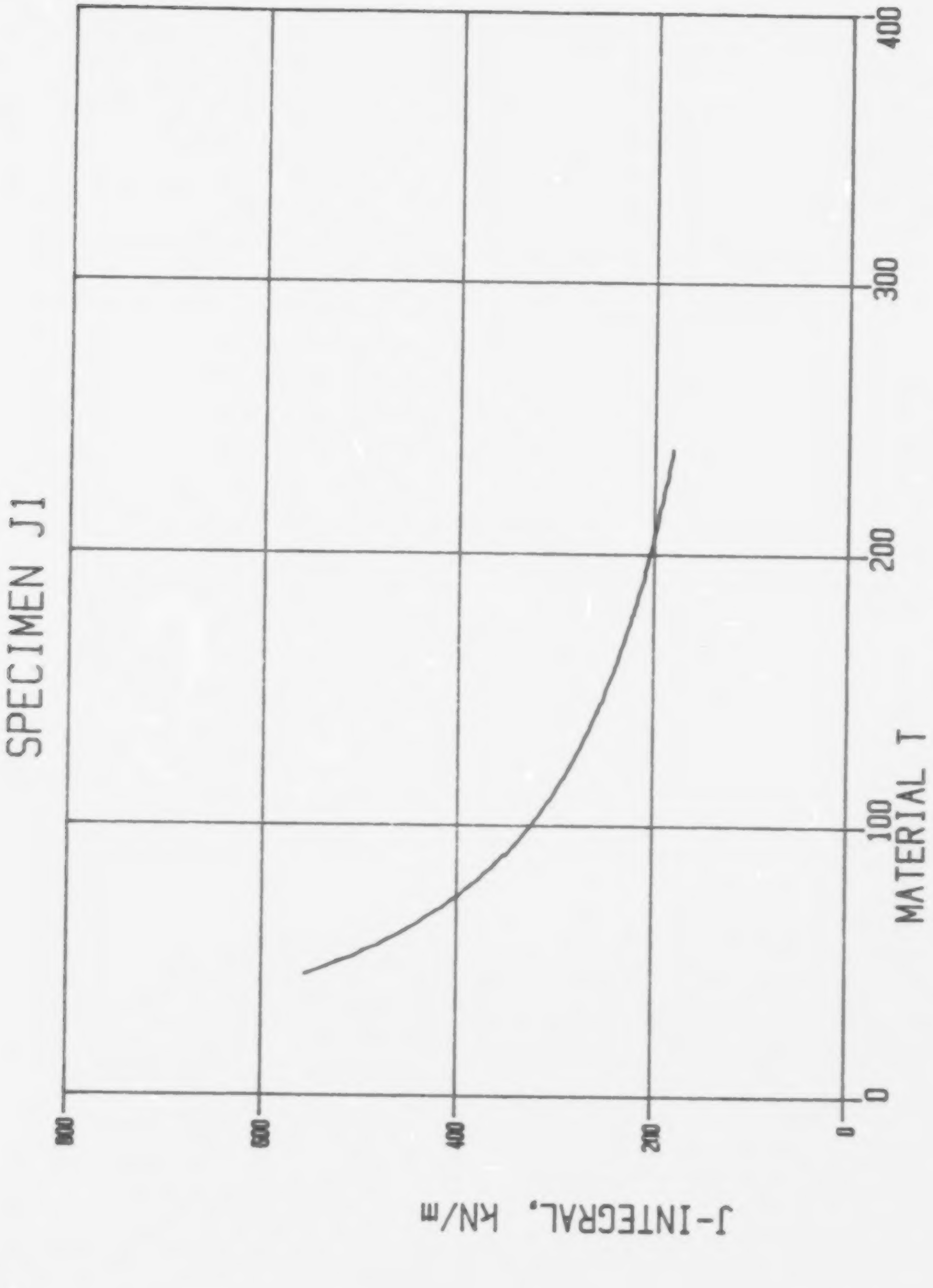
FRACTURE SURFACES SPECIMEN# 2S AND 50S

APPENDIX D

Graphs and Tables from All Tests


J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
SPECIMEN J1 (250C)
SLOPE 94
INTERCEPT 161
J1C 185


LEGEND
+ J01 (ALL DATA)
LOAD LINE DISPLACEMENT (MM)
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60


SPECIMEN J1

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J1
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	228
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	510.8
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	3.175
PERCENT SIDE GROOVE	19.779
SPECIMEN WIDTH W(CM)	6.365
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.00191091E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	18.62
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.62

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.715
INITIAL A/W	.569
AVERAGE CRACK EXTENSION 9PT(CM)	.613
DELTA A(CM) COMPLIANCE	.565
MAX DEVIATION OF SINGLE MEASUREMENT %	1.3

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	19
LAST POINT	25
JIC(KN/M)	185
CORRELATION COEFF	.95
SLOPE M(MPa)	94
INTERCEPT B (KN/M)	161

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	470.43
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	402.66
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.745
25*JQ/EF.Y.(CM)	1.252

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	19
LAST DATA POINT USED	36
CONSTANT(C1)	259.28
EXPONENT(C2)	.4025

J1 (250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
13.13	.86	.02	.88	.88	.92	3.622	1
19.87	1.97	-.02	1.95	1.95	2.04	3.633	2
26.4	3.47	.22	3.69	3.69	3.87	3.624	3
33.11	5.46	.69	6.15	6.15	6.42	3.634	4
39.53	7.78	1.42	9.19	9.2	9.59	3.632	5
45.28	10.21	3.83	14.04	14.03	14.57	3.618	6
50.46	12.68	7.57	20.24	20.24	20.89	3.622	7
54.72	14.91	13.95	28.86	28.85	29.62	3.619	8
58.24	16.89	22.62	39.51	39.55	40.37	3.626	9
60.96	18.5	33.45	51.95	51.89	52.91	3.618	10
63.67	20.18	45.02	65.2	65.2	66.24	3.621	11
66.05	21.72	58.05	79.78	79.9	80.87	3.627	12
68.46	23.34	71.48	94.82	95.11	95.99	3.633	13
70.22	24.55	86.87	111.42	111.62	112.65	3.63	14
72.28	26.01	102.33	128.34	128.94	129.63	3.64	15
73.77	27.09	119.35	146.44	146.95	147.79	3.638	16
75.91	28.69	134.97	163.66	165.22	165.04	3.656	17
76.88	29.42	154.65	184.07	185.19	185.51	3.649	18
79.01	31.08	171.13	202.21	205.32	203.67	3.676	19
79.98	31.85	191.23	223.08	226.97	224.54	3.685	20
81.39	32.98	209.89	242.87	248.3	244.34	3.701	21
83.08	34.36	227.82	262.19	270.06	263.66	3.725	22
83.97	35.1	248.33	283.44	293.34	284.89	3.743	23
84.65	35.68	269.65	305.33	317.19	306.75	3.759	24
86.69	37.41	285.06	322.47	340.54	323.87	3.804	25
87.61	38.21	305.02	343.24	366.32	344.55	3.839	26
87.75	38.33	327.76	366.09	391.95	367.34	3.856	27
89.36	39.76	343.93	383.69	416.65	384.9	3.898	28
89.92	40.25	363.68	403.94	442.89	405.04	3.932	29
91.27	41.47	381.19	422.66	467.65	423.73	3.963	30
91.85	42.01	398.47	440.48	494.84	441.43	4.009	31
92.36	42.47	417.85	460.32	521.05	461.18	4.038	32
93.03	43.09	435.33	478.42	546.97	479.2	4.072	33
91.96	42.1	457.42	499.53	576.03	500.08	4.105	34
92.75	42.83	472.31	515.14	601.45	515.62	4.143	35
92.32	42.43	489.06	531.49	629.01	531.79	4.185	36

H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

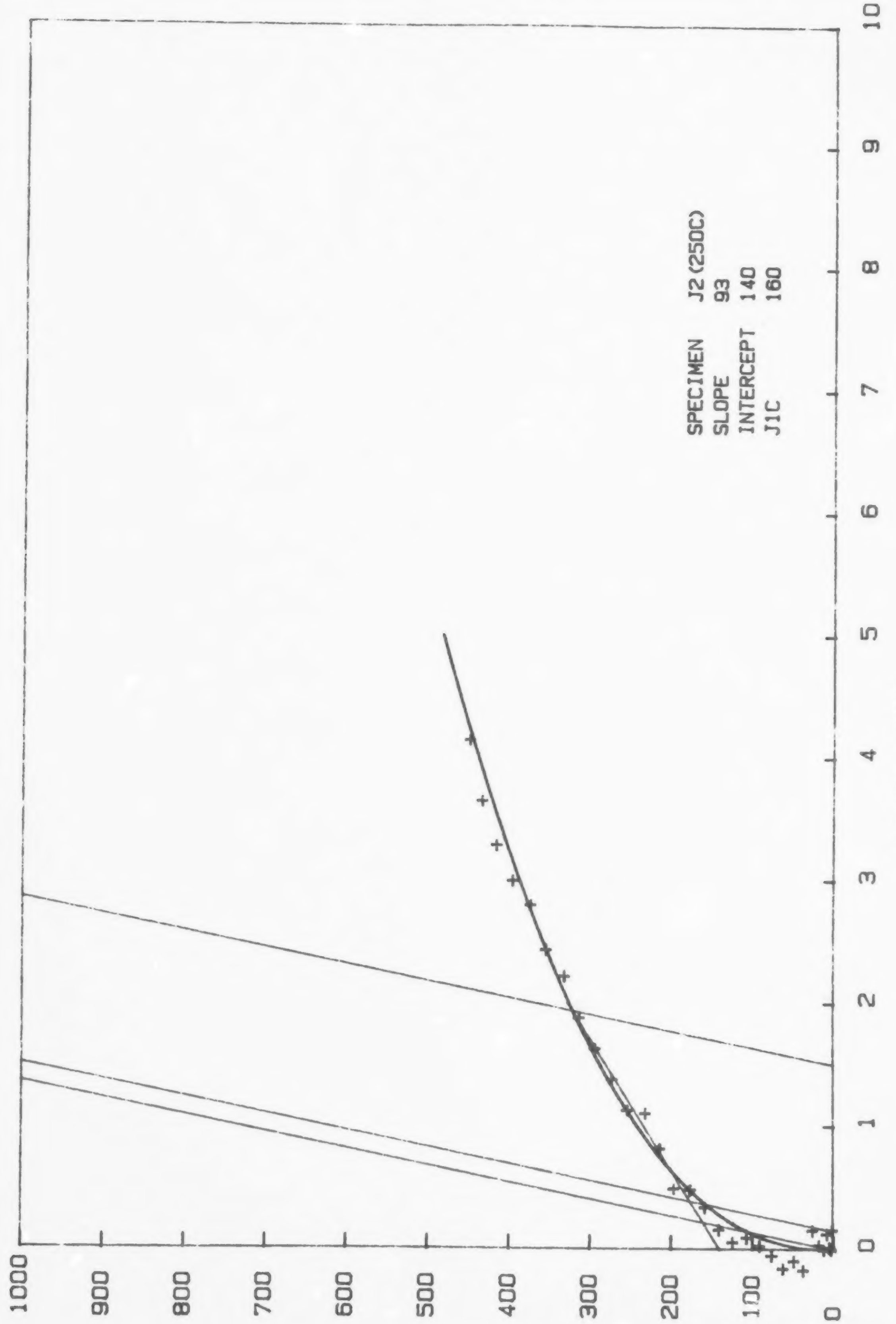
J1

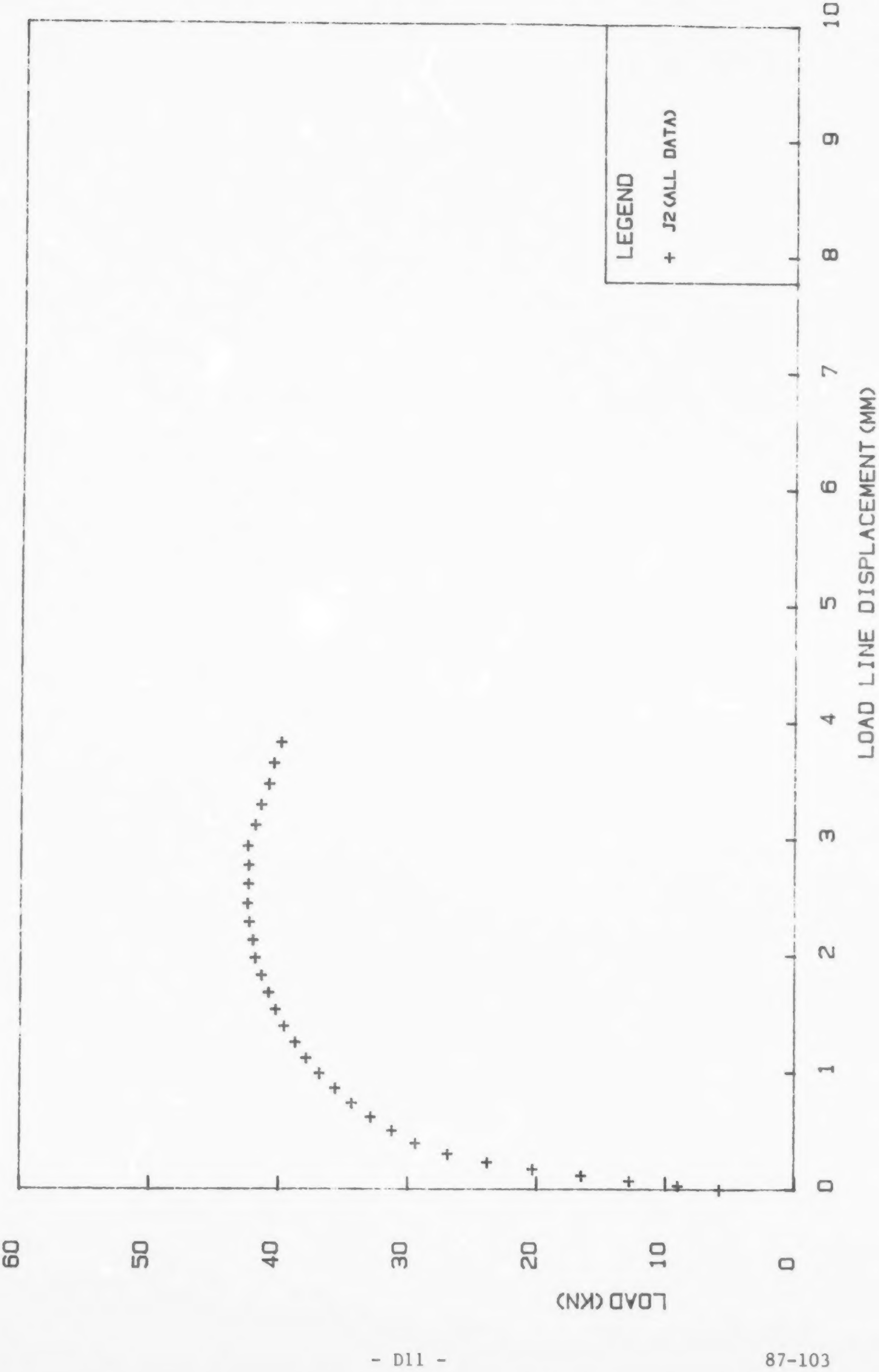
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.88	3.622	3.622	.022	.9995	1
1.95	3.633	3.633	.13	.9999	2
3.69	3.624	3.624	.043	.9998	3
6.15	3.633	3.634	.143	.9999	4
9.19	3.631	3.632	.125	.9999	5
14.04	3.616	3.618	-.025	.9998	6
20.24	3.62	3.622	.02	.9999	7
28.86	3.617	3.619	-5E-03	.9999	8
39.51	3.623	3.626	.061	.9999	9
51.95	3.614	3.618	-.022	.9999	10
65.2	3.617	3.621	.013	.9999	11
79.78	3.622	3.627	.071	.9999	12
94.82	3.627	3.633	.13	.9999	13
111.42	3.623	3.63	.103	.9998	14
128.34	3.632	3.64	.198	.9997	15
146.44	3.629	3.638	.18	.9999	16
163.66	3.647	3.656	.361	.9997	17
184.07	3.639	3.649	.294	.9995	18
202.21	3.665	3.676	.558	.9999	19
223.08	3.673	3.685	.651	.9997	20
242.87	3.688	3.701	.814	.9998	21
262.19	3.711	3.725	1.049	.9997	22
283.44	3.728	3.743	1.229	.9998	23
305.33	3.743	3.759	1.386	.9998	24
322.47	3.788	3.804	1.844	.9997	25
343.24	3.822	3.839	2.189	.9997	26
366.09	3.839	3.856	2.365	1	27
383.69	3.88	3.898	2.783	.9997	28
403.94	3.912	3.932	3.115	.9998	29
422.66	3.943	3.963	3.429	.9997	30
440.48	3.988	4.009	3.887	.9998	31
460.32	4.017	4.038	4.181	.9997	32
478.42	4.05	4.072	4.522	.9998	33
499.53	4.083	4.105	4.851	.9999	34
515.14	4.12	4.143	5.232	.9999	35
531.49	4.161	4.185	5.649	.9997	36

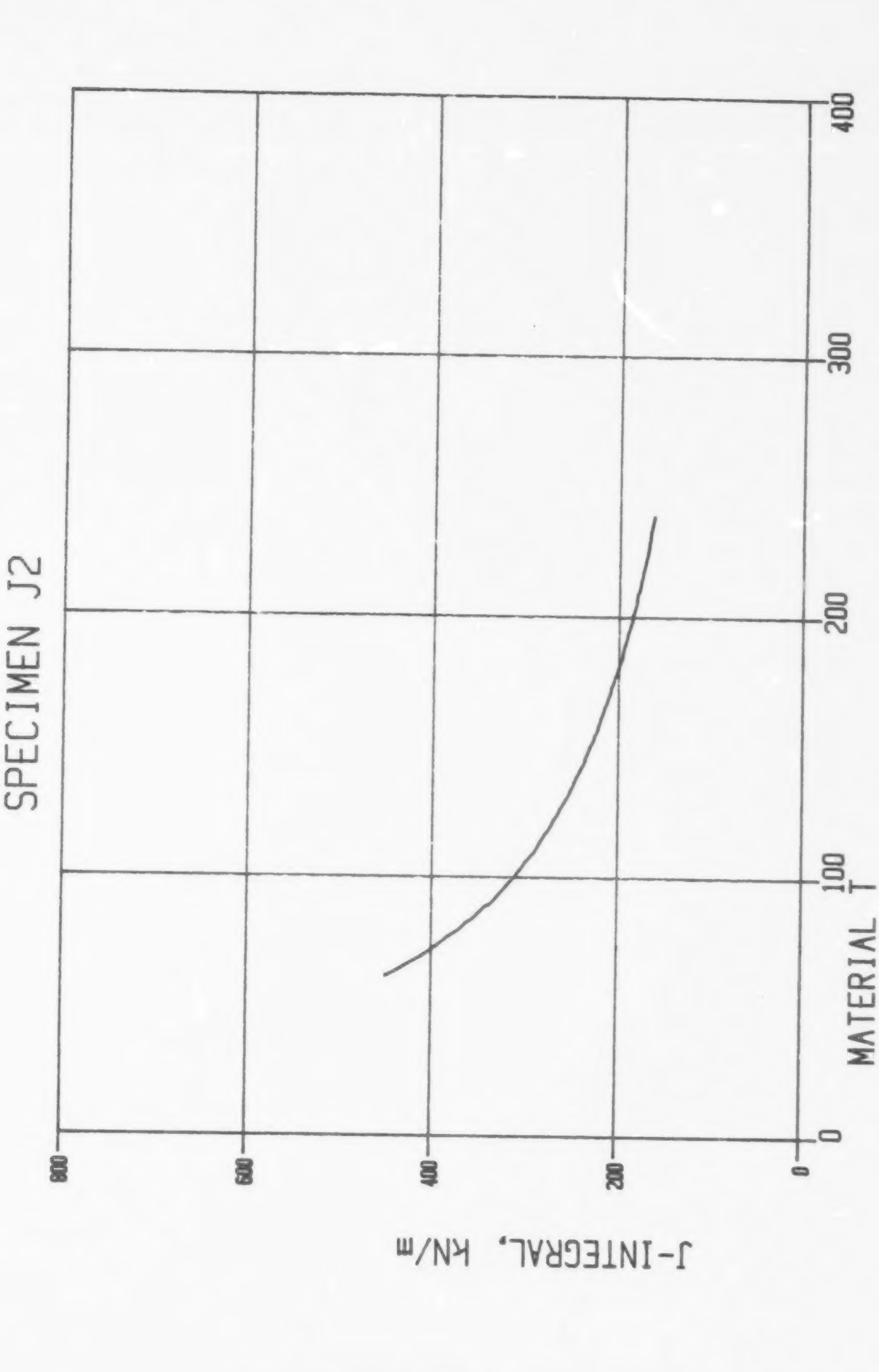
J1

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	4.578	0
2	7.751	.032
3	11.658	.068
4	15.564	.11
5	19.409	.156
6	23.193	.203
7	26.794	.264
8	29.785	.334
9	32.349	.422
10	34.302	.525
11	36.072	.635
12	37.598	.75
13	38.879	.872
14	40.161	.994
15	41.26	1.121
16	42.236	1.252
17	43.152	1.384
18	43.945	1.519
19	44.678	1.658
20	45.227	1.802
21	45.532	1.951
22	45.898	2.097
23	46.204	2.246
24	46.204	2.402
25	46.143	2.561
26	45.959	2.722
27	45.471	2.896
28	45.044	3.064
29	44.678	3.232
30	44.006	3.408
31	43.762	3.574
32	42.725	3.76
33	42.114	3.936
34	41.443	4.111
35	40.039	4.309
36	39.307	4.487
37	37.964	4.683

	J(KN/M)	T	W	J1
1	193.14	92.03	9.57	
2	212.65	299.79	28.21	
3	232.98	162.84	13.9	
4	252.53	109.87	8.58	
5	272.81	158.45	11.37	
6	294.38	186.33	12.32	
7	313.9	50.18	3.06	
8	332.85	80.62	4.57	
9	354.66	173.81	9.18	
10	374.89	56.33	2.77	
11	393.82	81.73	3.77	
12	413.3	79.96	3.47	
13	431.57	52.06	2.12	
14	450.4	90.3	3.48	
15	469.37	71.24	2.6	
16	488.97	85.95	2.97	
17	507.33	54.79	1.79	
18	523.31	52.54	1.63	


SPECIMEN J2(250C)
SLOPE 93
INTERCEPT 140
J1C 160
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J2 (ALL DATA)


SPECIMEN J2
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J2
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	228
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	510.8
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	3.174
PERCENT SIDE GROOVE	19.754
SPECIMEN WIDTH W(CM)	6.361
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	1.98320038E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	19.79
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.723

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.818
INITIAL A/W	.585
AVERAGE CRACK EXTENSION 9PT(CM)	.401
DELTA A(CM) COMPLIANCE	.414
MAX DEVIATION OF SINGLE MEASUREMENT %	1.2

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	17
LAST POINT	24
JIC(KN/M)	160
CORRELATION COEFF	.97
SLOPE M(MPa)	93
INTERCEPT B (KN/M)	140

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	470.43
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	410.73
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.638
25*JQ/EF.Y.(CM)	1.083

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	17
LAST DATA POINT USED	31
CONSTANT(C1)	242.43
EXPONENT(C2)	.4292

J2(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
16.41	1.34	-.01	1.33	1.33	1.39	3.739	1
23.06	2.65	.12	2.77	2.77	2.91	3.723	2
29.79	4.42	.49	4.91	4.91	5.15	3.725	3
36.84	6.76	1.18	7.94	7.94	8.3	3.735	4
42.93	9.18	2.98	12.16	12.15	12.67	3.723	5
48.53	11.73	6.28	18.01	18.01	18.67	3.727	6
53.42	14.21	11.92	26.13	26.17	26.91	3.738	7
55.66	15.42	22.11	37.54	37.38	38.46	3.706	8
58.87	17.25	31.95	49.2	49.13	50.2	3.714	9
61.26	18.68	43.85	62.53	62.36	63.63	3.707	10
63.94	20.35	56.15	76.5	76.56	77.67	3.718	11
66.44	21.98	69.39	91.36	91.64	92.6	3.726	12
68.57	23.41	83.81	107.22	107.73	108.52	3.732	13
69.97	24.38	100.03	124.41	124.77	125.77	3.729	14
71.95	25.77	115.58	141.35	142.21	142.76	3.739	15
73.96	27.24	131.38	158.62	160.53	160.05	3.757	16
75.62	28.47	148.5	176.97	179.83	178.43	3.771	17
76.68	29.27	167.59	196.87	199.79	198.36	3.772	18
79.13	31.17	183.08	214.25	219.91	215.75	3.804	19
80.9	32.58	199.91	232.5	240.86	233.98	3.833	20
81.61	33.16	221.44	254.59	263.2	256.09	3.836	21
83.14	34.41	239.33	273.74	285.22	275.22	3.861	22
84.33	35.41	259.45	294.86	309.43	296.29	3.886	23
85.69	36.56	277.49	314.05	332.01	315.46	3.911	24
87.72	38.31	294.5	332.81	355.75	334.2	3.945	25
87.69	38.29	317.34	355.63	381.95	356.9	3.966	26
88.93	39.38	334.99	374.37	406.92	375.56	4.003	27
88.8	39.26	357.84	397.1	433.26	398.18	4.023	28
89.74	40.1	377.05	417.15	458.95	418.15	4.051	29
90.77	41.02	393.79	434.81	484.15	435.74	4.088	30
91.85	42	408.04	450.04	510.32	450.86	4.137	31

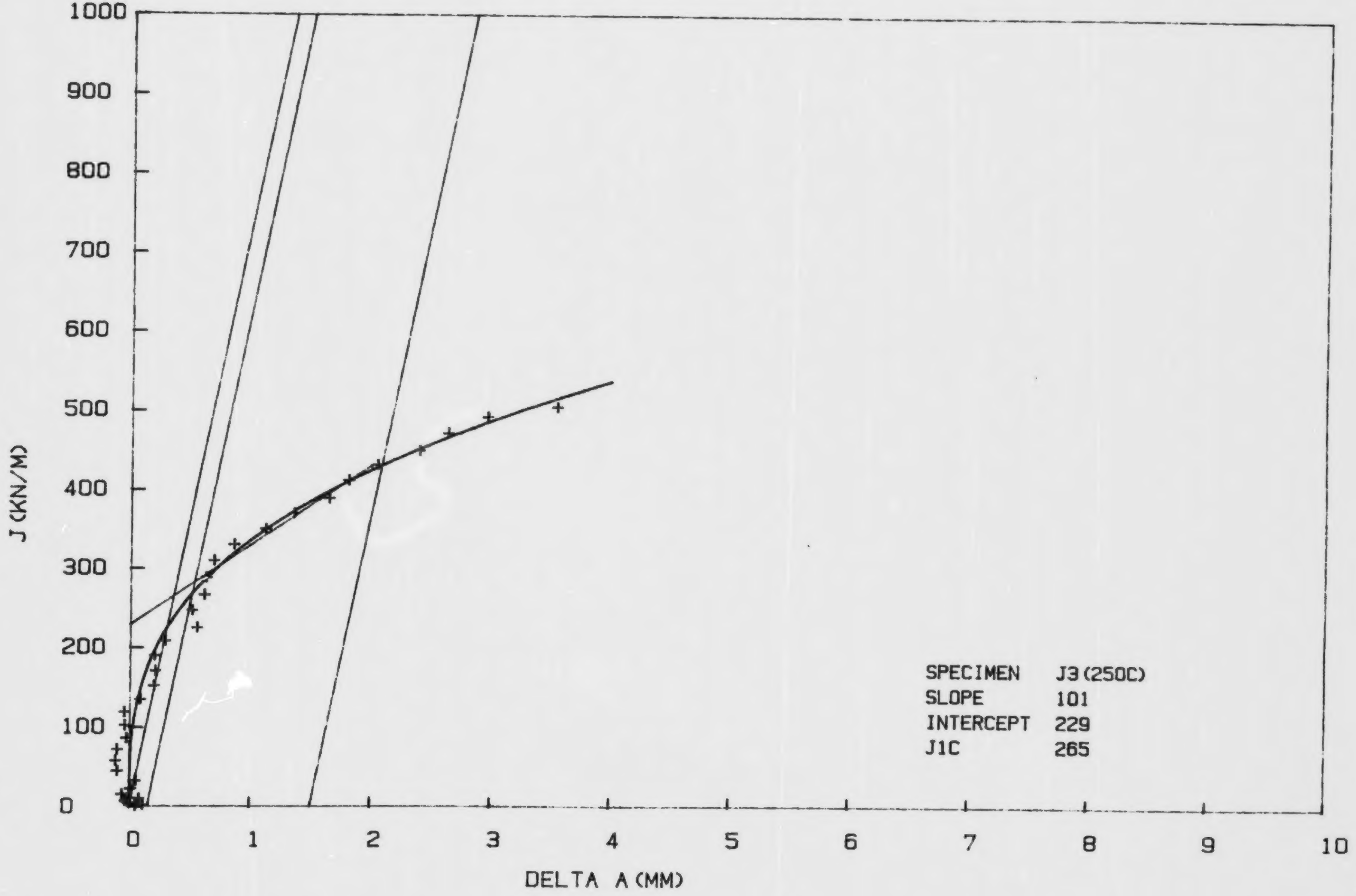
H(M)	D(M)	POISSON'S RATIO
.02385	2.54E-03	.3

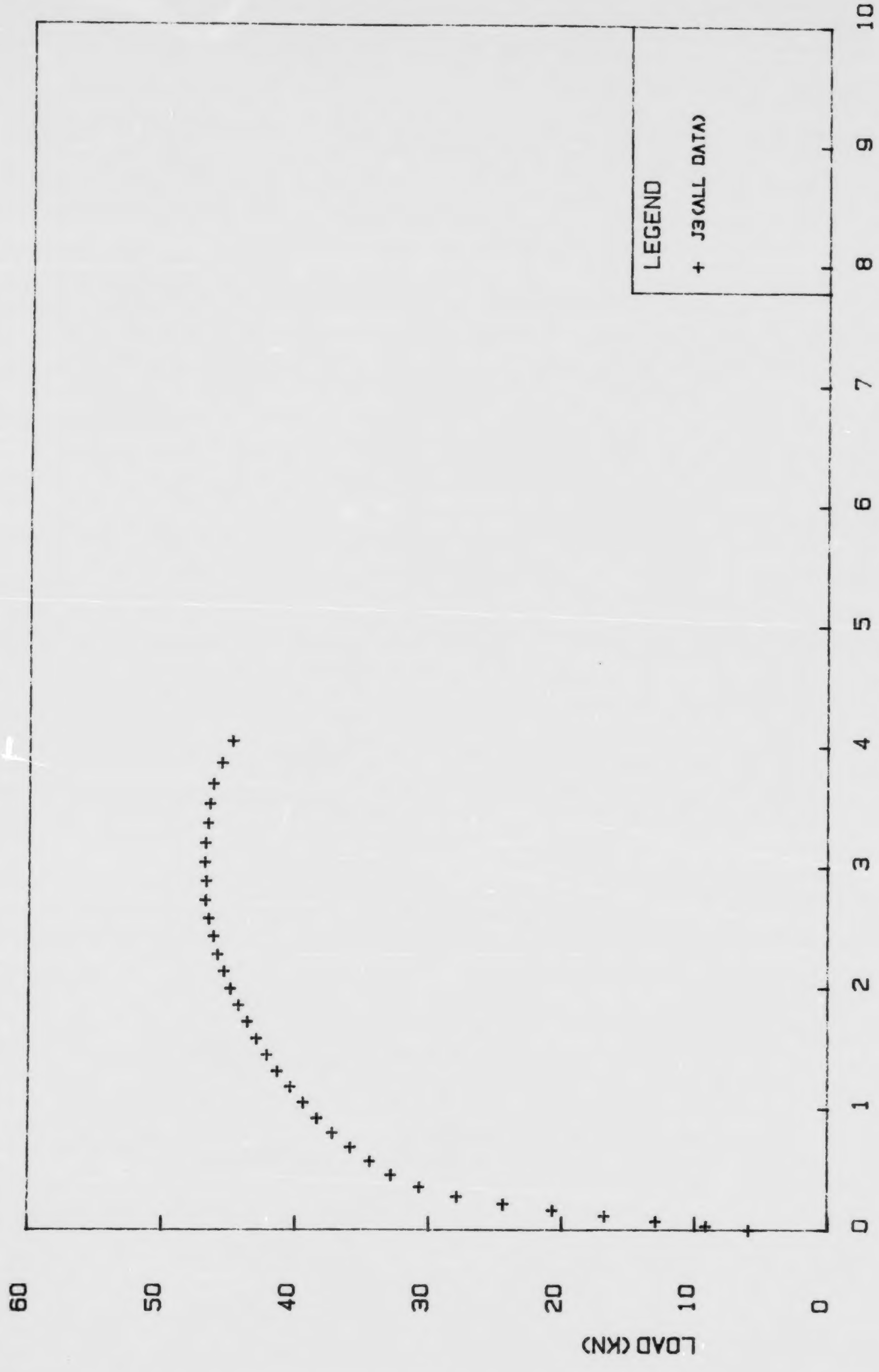
J2

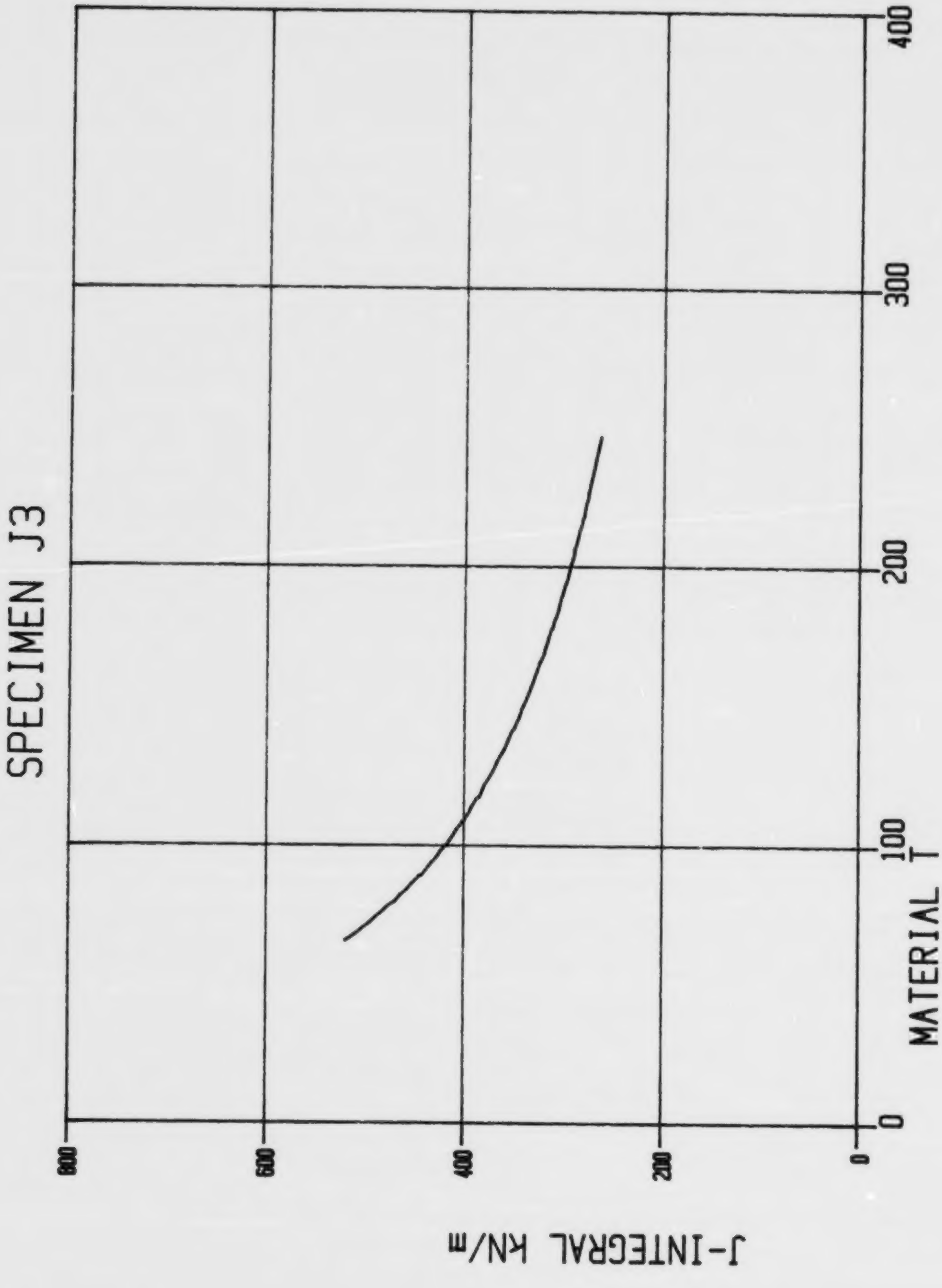
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.33	3.739	3.739	.158	.9979	1
2.77	3.722	3.723	-1E-03	.9996	2
4.91	3.724	3.725	.015	.9993	3
7.94	3.734	3.735	.125	.9993	4
12.16	3.721	3.723	-5E-03	.9995	5
18.01	3.725	3.727	.035	.9996	6
26.13	3.736	3.738	.154	.9997	7
37.54	3.703	3.706	-.173	.9998	8
49.2	3.71	3.714	-.094	.9996	9
62.53	3.703	3.707	-.158	.9997	10
76.5	3.713	3.718	-.053	.9994	11
91.36	3.72	3.726	.027	.9998	12
107.22	3.725	3.732	.092	.9997	13
124.41	3.721	3.729	.056	.9998	14
141.35	3.73	3.739	.157	.9996	15
158.62	3.748	3.757	.338	.9996	16
176.97	3.761	3.771	.481	.9996	17
196.87	3.761	3.772	.49	.9995	18
214.25	3.793	3.804	.813	.9997	19
232.5	3.821	3.833	1.102	.9996	20
254.59	3.822	3.836	1.126	.9997	21
273.74	3.847	3.861	1.377	.9996	22
294.86	3.871	3.886	1.626	.9997	23
314.05	3.895	3.911	1.876	.9997	24
332.81	3.928	3.945	2.216	.9997	25
355.63	3.949	3.966	2.431	.9997	26
374.37	3.985	4.003	2.797	.9998	27
397.1	4.004	4.023	2.995	.9994	28
417.15	4.032	4.051	3.283	.9995	29
434.81	4.068	4.088	3.645	.9997	30
450.04	4.117	4.137	4.142	.9995	31

```
              LOAD(KN)       LOAD LINE DISPLACEMENT(MM)      J2
 1             5.798          0
 2             9.033           .033
 3            12.817           .074
 4            16.541           .121
 5            20.325           .173
 6            23.865           .232
 7            26.917           .304
 8            29.419           .394
 9            31.25            .503
 10           32.898           .616
 11           34.363           .736
 12           35.645           .862
 13           36.865           .99
 14           37.903          1.122
 15           38.757          1.256
 16           39.612          1.393
 17           40.283          1.534
 18           40.833          1.68
 19           41.382          1.825
 20           41.87           1.975
 21           42.053          2.128
 22           42.358          2.283
 23           42.48           2.439
 24           42.419          2.609
 25           42.419          2.766
 26           42.48           2.932
 27           41.87           3.11
 28           41.443          3.285
 29           40.833          3.464
 30           40.466          3.643
 31           39.917          3.82
 32           39.001          4.008
```

	J(KN/M)	T	W	J2
1	167.8	172.37	19.86	
2	186.92	2859.46	295.68	
3	205.56	72.11	6.7	
4	223.38	84.65	7.15	
5	243.55	1237.23	95.78	
6	264.17	102	7.21	
7	284.3	113.81	7.4	
8	304.46	102.98	6.19	
9	323.43	73.85	4.12	
10	344.22	141.76	7.36	
11	365	68.67	3.31	
12	385.73	153.5	6.95	
13	407.12	93.33	3.95	
14	425.98	65.33	2.6	
15	442.42	41.05	1.54	


1000
900
800
700
600
500
400
300
200
100
0
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J3 (250C)
SLOPE 101
INTERCEPT 229
J1C 265


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J3(ALL DATA)


SPECIMEN J3
J-INTEGRAL kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                  J03
 MATERIAL TYPE                                    A106B
 MATERIAL CONDITION                               PARENT
 TEST TEMPERATURE(DEG C)                          250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        228
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      510.8
 CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
 SPECIMEN THICKNESS B(CM)                         3.175
 PERCENT SIDE GROOVE                              19.622
 SPECIMEN WIDTH W(CM)                             6.364
 YOUNGS MODULUS AT TEST TEMP(Pa)                  1.82776E+11
 EFFECTIVE MODULUS(Pa)                            1.98586693E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN            12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         19
 INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.655

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                   3.743
 INITIAL A/W                                      .574
 AVERAGE CRACK EXTENSION 9PT(CM)                  .394
 DELTA A(CM) COMPLIANCE                           .354
 MAX DEVIATION OF SINGLE MEASUREMENT %            .68

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     22
 LAST POINT                      30
 JIC(KN/M)                       265
 CORRELATION COEFF               .96
 SLOPE M(MPa)                    101
 INTERCEPT B (KN/M)              229

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                         YES
 CRACK SIZE DA<0.15*DELTA A                       YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  471.35
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                434.9
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 2.709
 25*JQ/EF.Y.(CM)                                  1.793

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       22
 LAST DATA POINT USED      34
 CONSTANT(C1)              336.52
 EXPONENT(C2)              .3387
```

J3(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
15.84	1.25	.02	1.27	1.27	1.33	3.66	1
22.47	2.51	.12	2.63	2.63	2.76	3.666	2
28.96	4.17	.5	4.67	4.67	4.89	3.655	3
35.64	6.32	.97	7.29	7.29	7.62	3.652	4
42.32	8.92	1.89	10.81	10.82	11.27	3.663	5
47.96	11.45	4.58	16.03	16.02	16.63	3.649	6
53	13.99	9.29	23.28	23.29	24.01	3.656	7
56.83	16.08	16.88	32.96	32.99	33.79	3.66	8
59.06	17.36	28.13	45.49	45.39	46.43	3.645	9
61.52	18.84	39.54	58.38	58.26	59.39	3.644	10
63.86	20.31	51.96	72.27	72.17	73.35	3.645	11
66.15	21.78	64.88	86.67	86.77	87.81	3.653	12
67.88	22.94	79.76	102.7	102.75	103.9	3.651	13
69.54	24.07	95.18	119.25	119.28	120.52	3.651	14
71.75	25.63	109.68	135.31	135.95	136.63	3.664	15
73.62	26.98	125.34	152.32	153.58	153.67	3.675	16
75.05	28.04	142.81	170.85	172.17	172.25	3.676	17
76.19	28.9	161.3	190.2	191.47	191.66	3.676	18
77.74	30.09	178.82	208.91	210.86	210.41	3.684	19
80.06	31.91	193.75	225.66	229.95	227.18	3.711	20
80.71	32.44	215.04	247.47	251.34	249.04	3.706	21
82.08	33.54	233.49	267.03	271.99	268.62	3.717	22
82.68	34.04	254.92	288.96	294.06	290.57	3.718	23
83.66	34.85	275.57	310.41	316.35	312.05	3.724	24
84.93	35.92	294.79	330.7	338.92	332.35	3.741	25
86.17	36.97	313.64	350.61	362.7	352.22	3.767	26
87.63	38.23	332.16	370.39	386.19	372	3.791	27
89.09	39.51	350.44	389.96	410.67	391.55	3.82	28
89.64	40	372.5	412.51	436.14	414.06	3.836	29
90.74	41	391.61	432.61	460.82	434.14	3.86	30
92.29	42.41	408.4	450.81	486.16	452.32	3.895	31
92.33	42.45	430.38	472.83	513.2	474.23	3.918	32
92.69	42.77	450.38	493.15	541.03	494.45	3.951	33
94.21	44.19	461.57	505.76	567.57	507.04	4.009	34

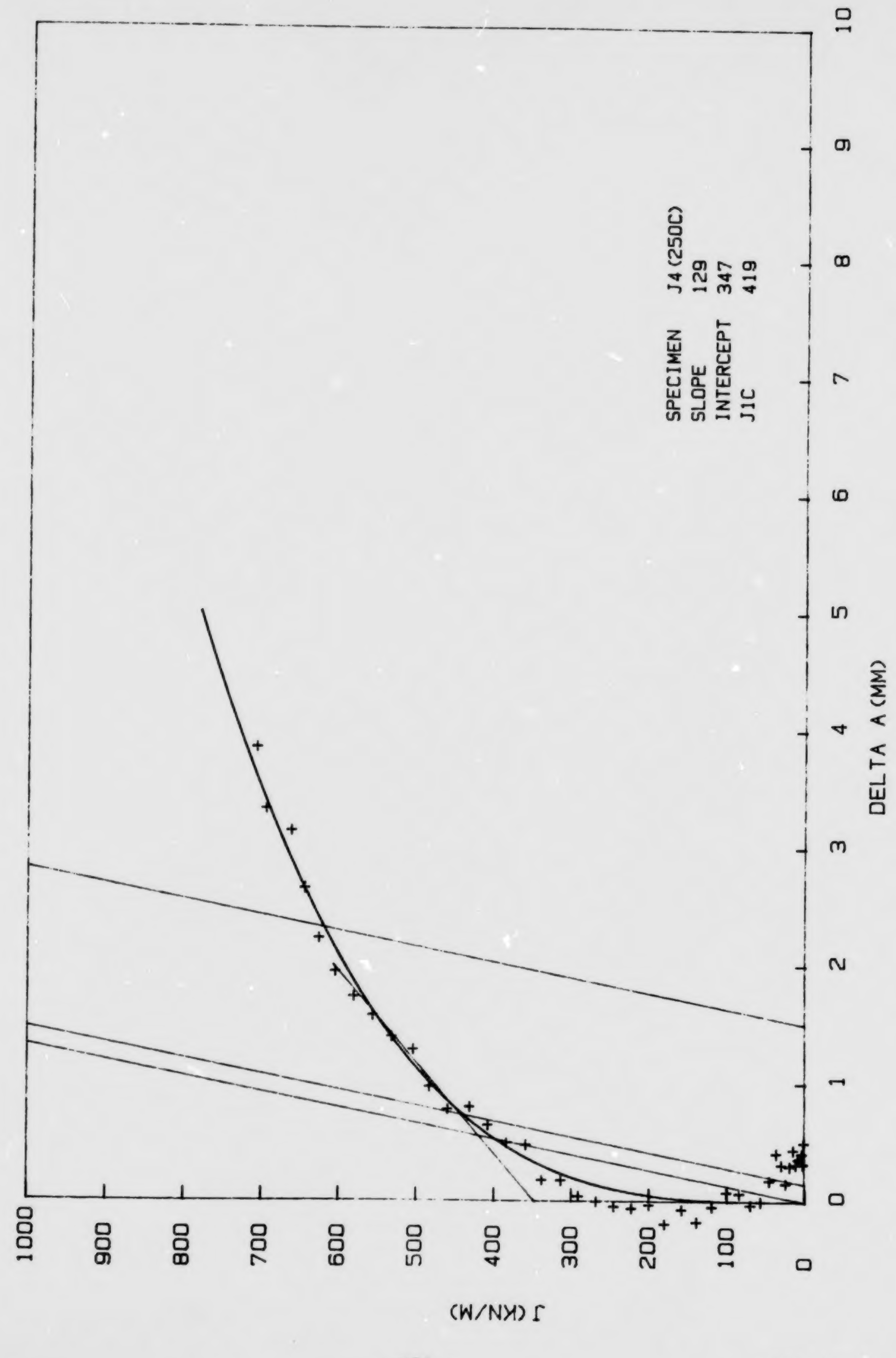
H(M)	D(M)	POISSON´S RATIO
.02387	2.54E-03	.3

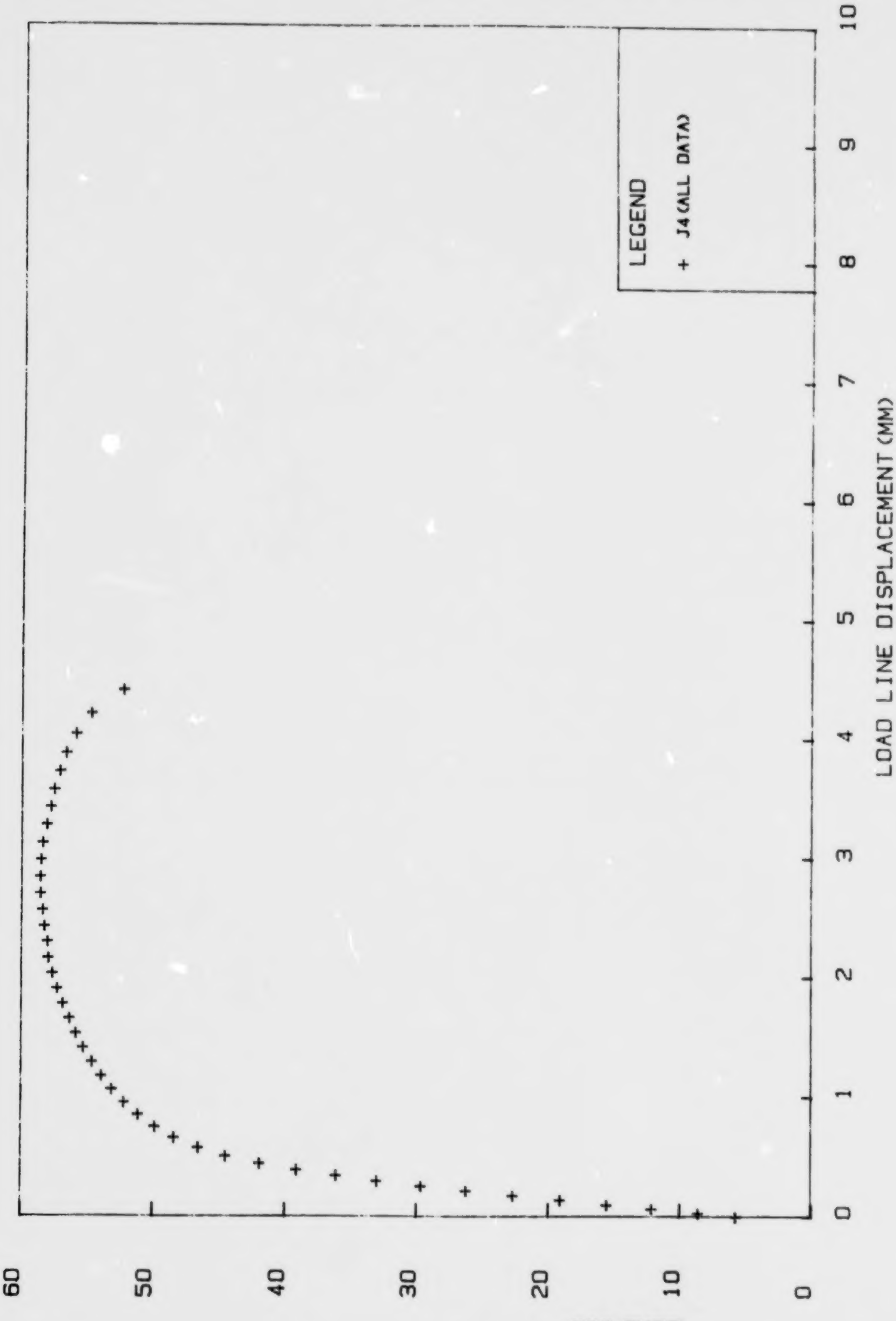
J03

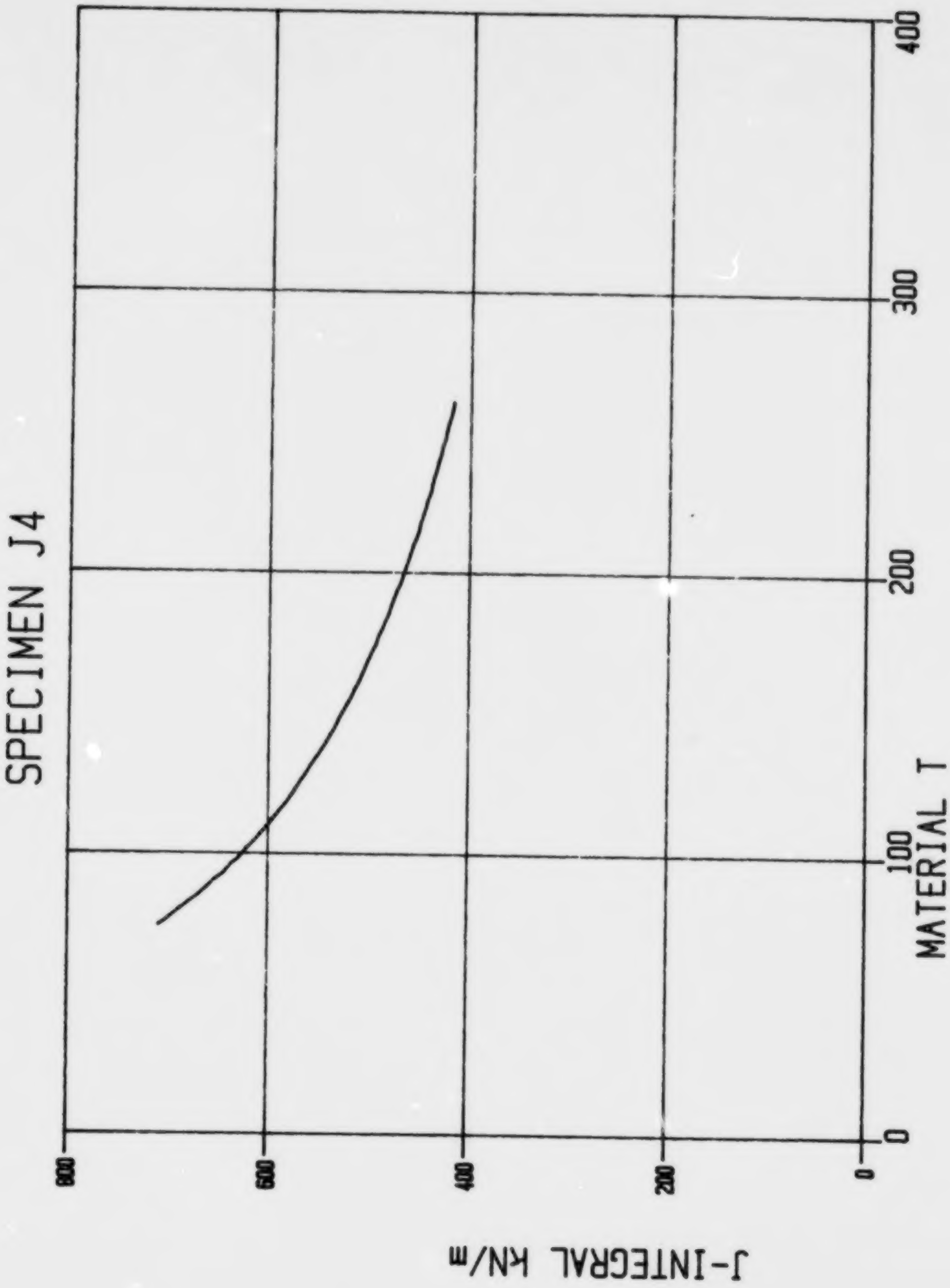
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.27	3.66	3.66	.052	.9994	1
2.63	3.666	3.666	.114	.9999	2
4.67	3.654	3.655	-2E-03	.9998	3
7.29	3.651	3.652	-.029	.9997	4
10.81	3.662	3.663	.082	.9997	5
16.03	3.647	3.649	-.06	.9999	6
23.28	3.654	3.656	.012	.9998	7
32.96	3.658	3.66	.053	.9998	8
45.49	3.642	3.645	-.098	.9997	9
58.38	3.639	3.644	-.113	.9998	10
72.27	3.64	3.645	-.101	.9995	11
86.67	3.647	3.653	-.023	.9997	12
102.7	3.645	3.651	-.038	.9998	13
119.25	3.643	3.651	-.044	.9996	14
135.31	3.656	3.664	.087	.9997	15
152.32	3.666	3.675	.202	.9999	16
170.85	3.666	3.676	.212	.9998	17
190.2	3.665	3.676	.205	.9997	18
208.91	3.673	3.684	.29	.9996	19
225.66	3.699	3.711	.558	.9997	20
247.47	3.693	3.706	.513	.9996	21
267.03	3.703	3.717	.615	.9999	22
288.96	3.703	3.718	.628	.9995	23
310.41	3.708	3.724	.693	.9996	24
330.7	3.724	3.741	.859	.9995	25
350.61	3.75	3.767	1.122	.9996	26
370.39	3.772	3.791	1.357	.9997	27
389.96	3.801	3.82	1.647	.9997	28
412.51	3.816	3.836	1.81	.9996	29
432.61	3.839	3.86	2.049	.9999	30
450.81	3.874	3.895	2.4	.9997	31
472.83	3.896	3.918	2.635	.9999	32
493.15	3.929	3.951	2.965	.9995	33
505.76	3.986	4.009	3.544	.9999	34

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J03
1	5.92	0	
2	9.155	.033	
3	12.939	.073	
4	16.785	.117	
5	20.691	.162	
6	24.414	.214	
7	27.893	.276	
8	30.701	.355	
9	32.837	.452	
10	34.424	.565	
11	35.889	.68	
12	37.231	.8	
13	38.391	.922	
14	39.429	1.05	
15	40.405	1.179	
16	41.382	1.309	
17	42.175	1.442	
18	42.969	1.577	
19	43.64	1.715	
20	44.312	1.853	
21	44.922	1.99	
22	45.41	2.134	
23	45.898	2.274	
24	46.204	2.421	
25	46.57	2.568	
26	46.814	2.719	
27	46.753	2.877	
28	46.875	3.032	
29	46.814	3.193	
30	46.631	3.357	
31	46.509	3.517	
32	46.265	3.683	
33	45.593	3.856	
34	44.8	4.038	
35	43.823	4.22	

	J(KN/M)	T	W	J03
1	257.25	255.52	19.63	
2	277.99	2267	161.11	
3	299.68	441.04	29	
4	320.56	163.73	10	
5	340.66	101.5	5.78	
6	360.5	112.91	6.02	
7	380.17	90.22	4.51	
8	401.23	185.26	8.71	
9	422.56	112.84	4.99	
10	441.71	69.46	2.9	
11	461.82	125.51	4.96	
12	482.99	82.55	3.08	
13	499.46	29.16	1.03	


SPECIMEN J4(250C)
SLOPE 129
INTERCEPT 347
J1C 419
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J4 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10



SPECIMEN J4

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     DATA SHEET-J1-R CURVE TEST

                   TEST SPECIMEN DATA

  SPECIMEN NUMBER                                        J04
  MATERIAL TYPE                                          A106B
  MATERIAL CONDITION                                     WELD(PN108)
  TEST TEMPERATURE(DEG C)                                250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)              275.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)            482
  CRACK PLANE ORIENTATION (PER ASTM E399)                L-C
  SPECIMEN THICKNESS B(CM)                               3.047
  PERCENT SIDE GROOVE                                    21.234
  SPECIMEN WIDTH W(CM)                                   6.36
  YOUNGS MODULUS AT TEST TEMP(Pa)                        1.82776E+11
  EFFECTIVE MODULUS(Pa)                                  1.97257063E+11

                   FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                  12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM               18.74
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                    3.554

                   CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                         3.681
  INITIAL A/W                                            .559
  AVERAGE CRACK EXTENSION 9PT(CM)                        .407
  DELTA A(CM) COMPLIANCE                                 .385
  MAX DEVIATION OF SINGLE MEASUREMENT %                  .27

                   ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                           31
  LAST POINT                            39
  JIC(KN/M)                             419
  CORRELATION COEFF                     .97
  SLOPE M(MPa)                          129
  INTERCEPT B (KN/M)                    347

                   VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD              NO
  LIGAMENT>25JIC/EFFECTIVE YIELD        NO
  DJ/DA<EFFECTIVE YIELD                 YES

                   QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                               NO
  CRACK SIZE DA<0.15*DELTA A                             YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                        454.38
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                      458.39
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                       2.806
  25*JQ/EF.Y.(CM)                                        2.766

                   CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED         31
  LAST DATA POINT USED        43
  CONSTANT(C1)                482.7
  EXPONENT(C2)                .2979
```

J4(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
15.21	1.15	0	1.15	1.15	1.17	3.605	1
21.25	2.25	.09	2.34	2.34	2.43	3.587	2
27.37	3.73	.1	3.83	3.83	3.99	3.595	3
33.51	5.59	.42	6.01	6.01	6.28	3.591	4
39.81	7.89	.64	8.54	8.54	8.93	3.59	5
45.91	10.49	1.23	11.72	11.72	12.26	3.586	6
52.25	13.59	1.52	15.11	15.11	15.82	3.598	7
57.7	16.58	3	19.58	19.57	20.46	3.584	8
62.64	19.53	5.29	24.82	24.8	25.86	3.57	9
68.42	23.31	6.87	30.18	30.2	31.43	3.586	10
73.73	27.07	9.84	36.9	36.95	38.37	3.595	11
77.24	29.7	16.26	45.97	45.9	47.57	3.572	12
80.04	31.89	25.2	57.09	56.89	58.81	3.554	13
83.04	34.33	35.79	70.13	69.89	71.97	3.551	14
86.02	36.84	47.44	84.28	84.21	86.25	3.561	15
88.27	38.8	62.12	100.91	100.86	102.99	3.562	16
89.56	39.94	79.42	119.36	118.94	121.5	3.55	17
90.51	40.78	98.29	139.07	138.18	141.28	3.537	18
92.38	42.48	115.54	158.03	157.62	160.31	3.548	19
93.01	43.07	136.99	180.06	178.98	182.39	3.535	20
94.99	44.92	154.95	199.87	199.84	202.28	3.552	21
95.77	45.66	176.52	222.19	221.93	224.64	3.548	22
96.68	46.54	198.54	245.08	244.95	247.58	3.55	23
97.76	47.59	220.19	267.78	268.07	270.33	3.554	24
98.73	48.53	242.6	291.14	291.88	293.73	3.559	25
100.1	49.89	263.63	313.51	315.79	316.16	3.572	26
100.65	50.44	287.91	338.35	340.67	341.02	3.572	27
102.45	52.26	306.98	359.24	365.67	361.99	3.602	28
102.99	52.8	331.4	384.2	390.89	386.97	3.604	29
104.07	53.92	354.12	408.05	417.11	410.86	3.619	30
105.33	55.23	376.52	431.75	443.47	434.61	3.634	31
105.19	55.09	404.89	459.98	471.29	462.84	3.632	32
106.23	56.19	427.38	483.57	498.63	486.46	3.651	33
107.95	58.02	446.36	504.38	525.99	507.35	3.682	34
108.07	58.15	474.08	532.23	556.23	535.17	3.693	35
108.66	58.78	498.05	556.83	585.09	559.78	3.712	36
109.23	59.4	522.23	581.63	613.84	584.58	3.727	37
109.79	60.02	545.56	605.58	643.31	608.52	3.749	38
110.73	61.04	565.85	626.89	672.38	629.86	3.777	39
112.15	62.62	582.41	645.04	702.62	648.06	3.819	40
113.24	63.84	598.5	662.34	734.57	665.39	3.868	41
109.46	59.65	635.33	694.98	772.97	697.63	3.887	42
111.35	61.73	645.12	706.85	802.22	709.63	3.939	43

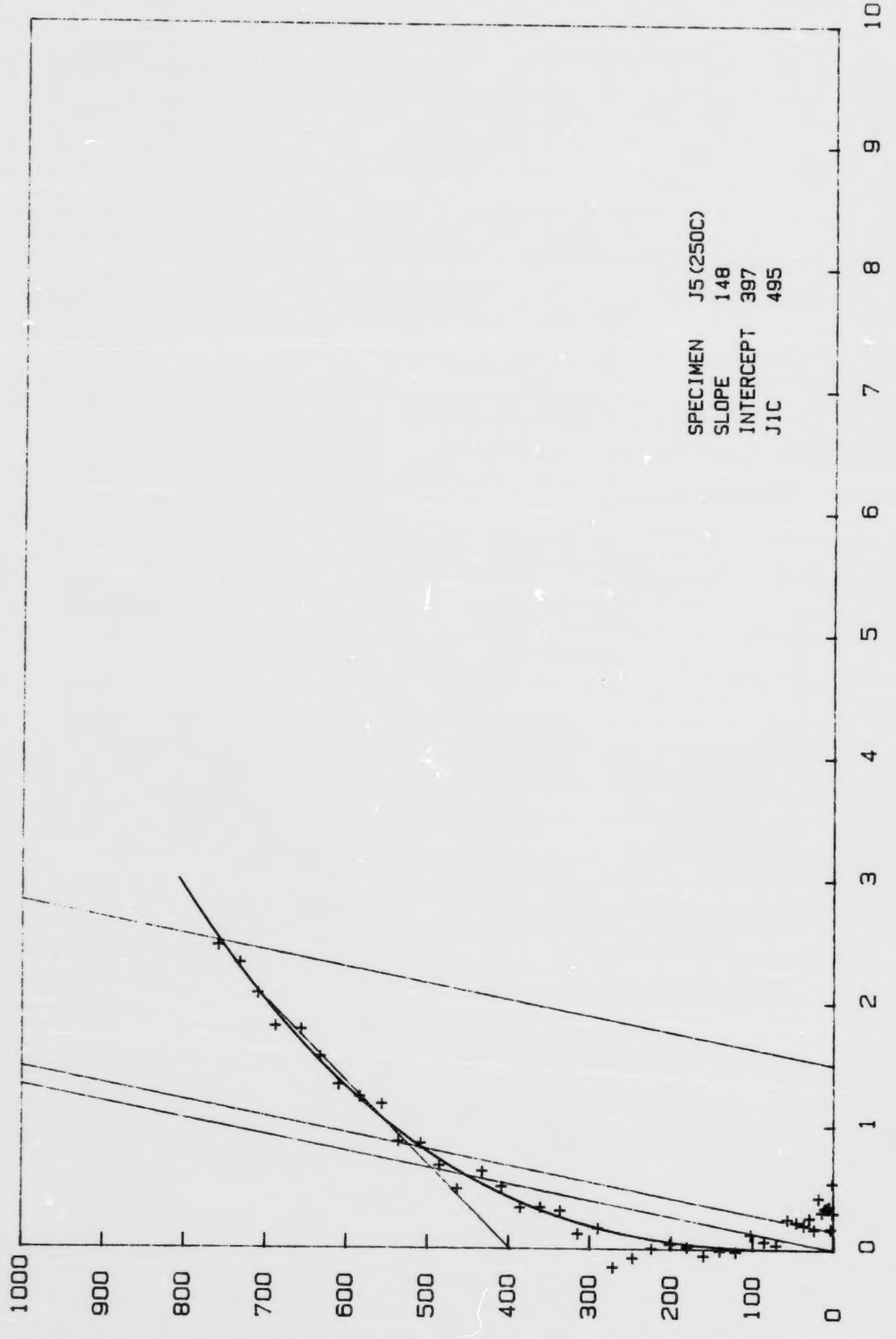
H(M)	D(M)	POISSON'S RATIO
.02382	2.54E-03	.3

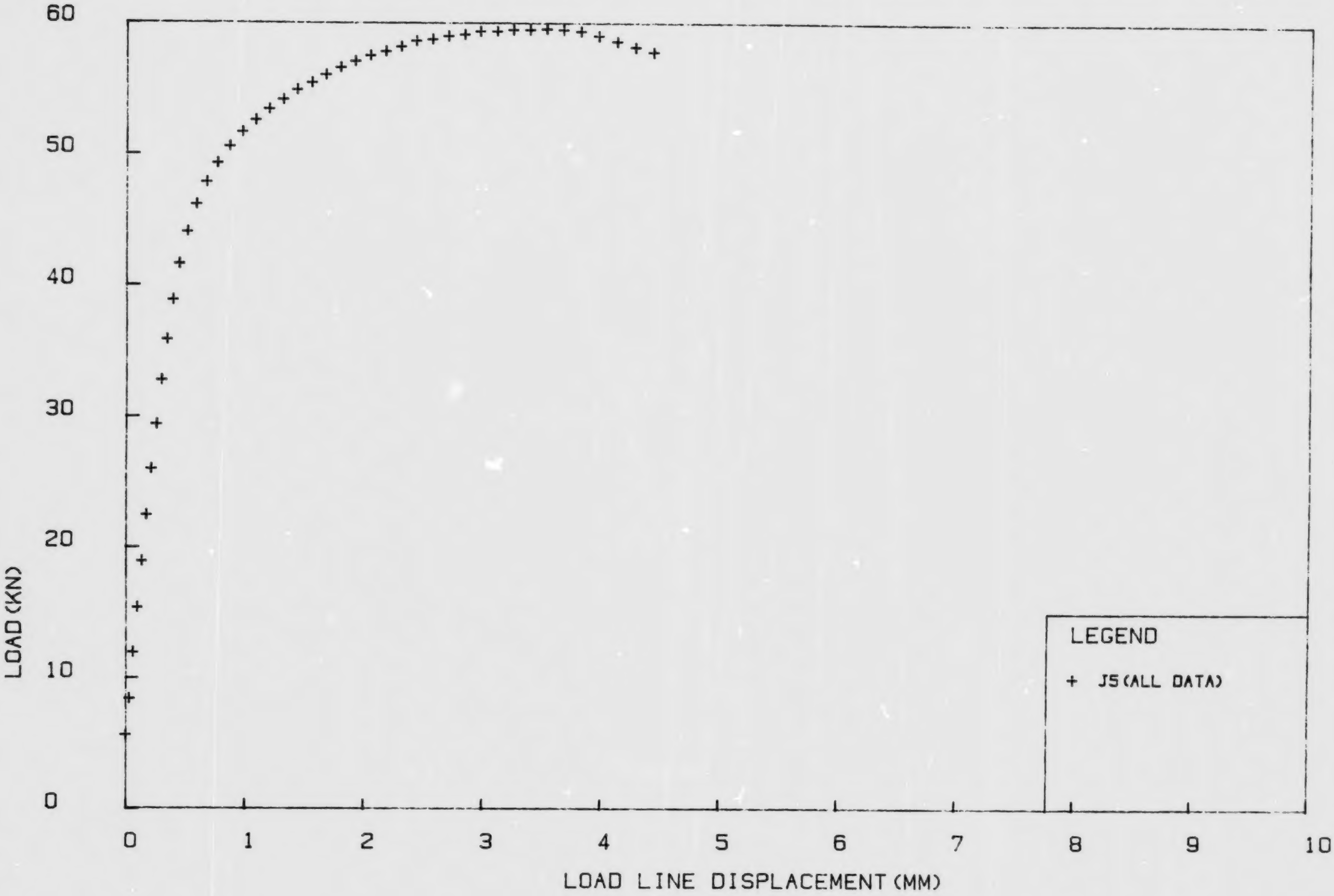
J04

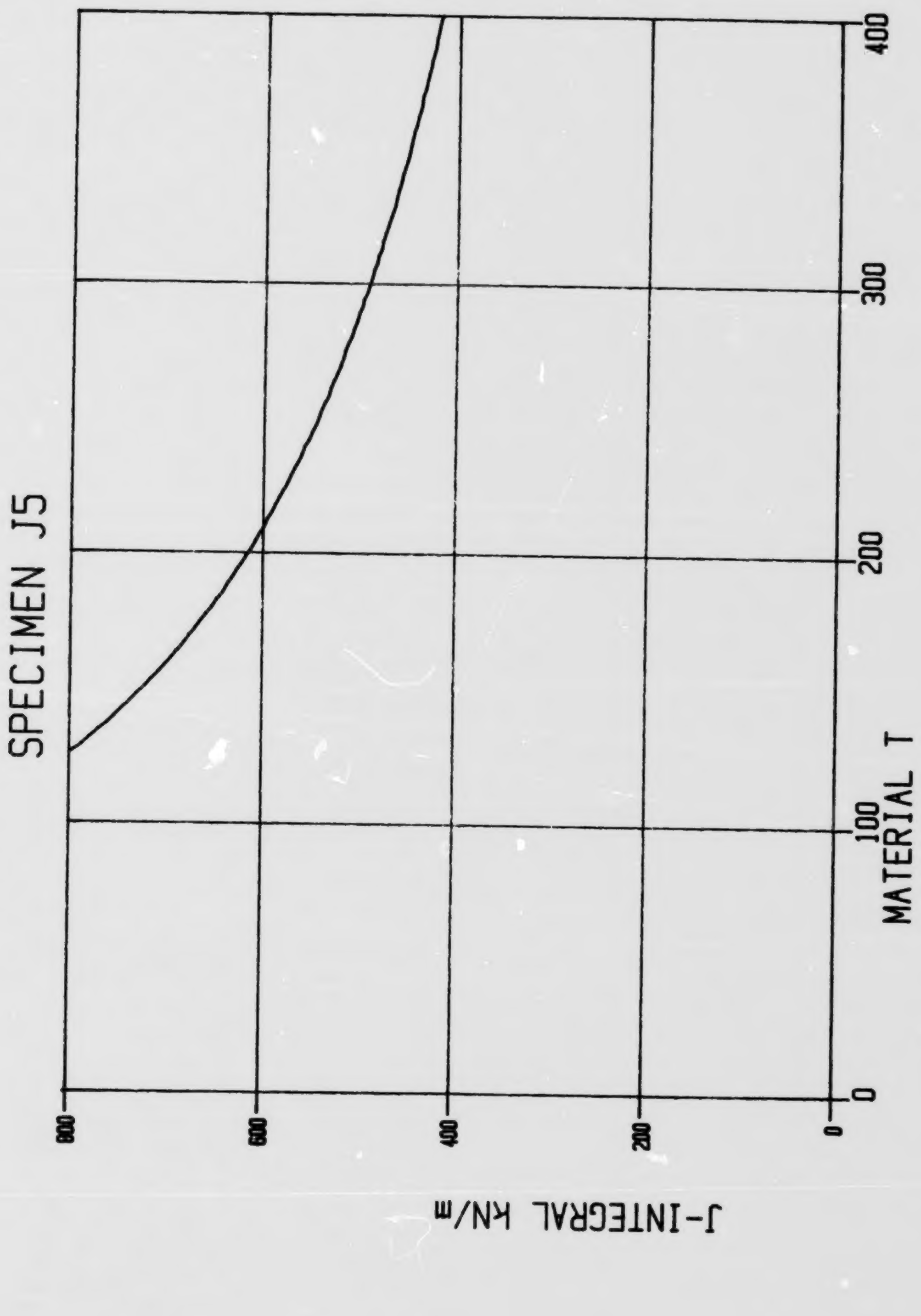
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.15	3.604	3.605	.505	.9991	1
2.34	3.586	3.587	.326	.9996	2
3.83	3.595	3.595	.414	.9994	3
6.01	3.59	3.591	.372	.9996	4
8.54	3.589	3.59	.365	.9997	5
11.72	3.585	3.586	.32	.9997	6
15.11	3.597	3.598	.444	.9997	7
19.58	3.583	3.584	.304	.9998	8
24.82	3.568	3.57	.16	.9998	9
30.18	3.583	3.586	.317	.9998	10
36.9	3.593	3.595	.414	.9997	11
45.97	3.569	3.572	.184	.9997	12
57.09	3.551	3.554	5E-03	.9995	13
70.13	3.547	3.551	-.026	.9999	14
84.28	3.556	3.561	.071	.9998	15
100.91	3.557	3.562	.08	.9997	16
119.36	3.544	3.55	-.042	.9994	17
139.07	3.53	3.537	-.167	.9995	18
158.03	3.54	3.548	-.065	.9996	19
180.06	3.527	3.535	-.186	.9996	20
199.87	3.542	3.552	-.024	.9991	21
222.19	3.538	3.548	-.056	.9993	22
245.08	3.539	3.55	-.041	.9997	23
267.78	3.543	3.554	4E-03	.9994	24
291.14	3.546	3.559	.047	.9996	25
313.51	3.559	3.572	.18	.9998	26
338.35	3.558	3.572	.184	.9995	27
359.24	3.587	3.602	.482	.9996	28
384.2	3.588	3.604	.499	.9994	29
408.05	3.602	3.619	.648	.9997	30
431.75	3.617	3.634	.803	.9997	31
459.98	3.614	3.632	.781	.9991	32
483.57	3.632	3.651	.971	.9993	33
504.38	3.663	3.682	1.285	.9995	34
532.23	3.673	3.693	1.393	.9999	35
556.83	3.69	3.712	1.575	.9998	36
581.63	3.705	3.727	1.735	.9997	37
605.58	3.725	3.749	1.946	.9996	38
626.89	3.753	3.777	2.229	.9995	39
645.04	3.795	3.819	2.651	.9996	40
662.34	3.843	3.868	3.141	.9997	41
694.98	3.861	3.887	3.326	.9998	42
706.85	3.913	3.939	3.848	.9997	43

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J04
1	5.737	0	
2	8.606	.028	
3	12.146	.063	
4	15.564	.098	
5	19.104	.137	
6	22.705	.175	
7	26.245	.215	
8	29.663	.254	
9	33.02	.297	
10	36.133	.342	
11	39.124	.388	
12	41.931	.441	
13	44.495	.5	
14	46.57	.571	
15	48.401	.654	
16	49.866	.745	
17	51.147	.845	
18	52.246	.948	
19	53.162	1.057	
20	53.955	1.169	
21	54.688	1.287	
22	55.359	1.405	
23	55.908	1.525	
24	56.396	1.649	
25	56.885	1.774	
26	57.312	1.901	
27	57.678	2.029	
28	57.983	2.158	
29	58.044	2.294	
30	58.289	2.423	
31	58.411	2.56	
32	58.594	2.697	
33	58.594	2.836	
34	58.533	2.977	
35	58.411	3.121	
36	58.105	3.274	
37	57.8	3.422	
38	57.556	3.568	
39	57.129	3.719	
40	56.641	3.871	
41	55.908	4.032	
42	54.749	4.204	
43	52.307	4.402	
44	51.453	4.568	

	J(KN/M)	T	W	J04
1	419.9	194.48	9.9	
2	445.86	-1599.26	-76.76	
3	471.77	157.84	7.11	
4	493.98	84.61	3.6	
5	518.31	326.34	13.17	
6	544.53	172.68	6.59	
7	569.23	198.26	7.19	
8	593.6	144.16	4.97	
9	616.23	95.97	3.16	
10	635.96	54.86	1.72	
11	653.69	45	1.35	
12	678.66	225.33	6.44	
13	700.92	28.95	.78	


SPECIMEN J5(250C)
SLOPE 148
INTERCEPT 397
J1C 495
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J5 (ALL DATA)


SPECIMEN J5
MATERIAL T
J-INTEGRAL kN/m
0
100
200
300
400
0
200
400
600
800

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DATA SHEET-J1-R CURVE TEST

                    TEST SPECIMEN DATA

SPECIMEN NUMBER                                       J05
MATERIAL TYPE                                         A106B
MATERIAL CONDITION                                    WELD(PN108)
TEST TEMPERATURE(DEG C)                               250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             275.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           482
CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
SPECIMEN THICKNESS B(CM)                              3.046
PERCENT SIDE GROOVE                                   21.208
SPECIMEN WIDTH W(CM)                                  6.365
YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
EFFECTIVE MODULUS(Pa)                                 2.0258538E+11

                    FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              18.78
INITIAL CRACK LENGTH-COMPLIANCE(CM)                   3.56

                    CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                        3.697
INITIAL A/W                                           .559
AVERAGE CRACK EXTENSION 9PT(CM)                       .282
DELTA A(CM) COMPLIANCE                                .246
MAX DEVIATION OF SINGLE MEASUREMENT %                 .86

                    ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                    34
LAST POINT                     44
JIC(KN/M)                      495
CORRELATION COEFF              .98
SLOPE M(MPa)                   148
INTERCEPT B (KN/M)             397

                    VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD       NO
LIGAMENT>25JIC/EFFECTIVE YIELD NO
DJ/DA<EFFECTIVE YIELD          YES

                    QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                              NO
CRACK SIZE DA<0.15*DELTA A                            YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       454.38
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     484.5
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.805
25*JQ/EF.Y.(CM)                                       3.268

                    CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED      34
LAST DATA POINT USED     44
CONSTANT(C1)             544.58
EXPONENT(C2)             .3582
```

J5(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
14.74	1.08	.01	1.1	1.1	1.13	3.59	1
21.22	2.24	-.1	2.14	2.14	2.23	3.614	2
26.72	3.55	.2	3.75	3.75	3.93	3.577	3
33.21	5.49	.27	5.76	5.76	6.04	3.595	4
39.39	7.73	.54	8.26	8.27	8.66	3.594	5
45.59	10.35	.94	11.29	11.3	11.84	3.594	6
51.49	13.2	1.81	15.01	15.01	15.71	3.59	7
57.74	16.6	2.55	19.15	19.16	20.04	3.602	8
62.33	19.34	5.18	24.52	24.51	25.56	3.576	9
67.87	22.93	7.48	30.42	30.42	31.65	3.586	10
72.43	26.12	11.46	37.57	37.56	38.98	3.58	11
76.78	29.35	17.4	46.75	46.75	48.34	3.582	12
80.5	32.26	25.48	57.74	57.75	59.48	3.585	13
82.52	33.91	37.67	71.58	71.34	73.42	3.564	14
85.18	36.13	50.17	86.29	86.11	88.25	3.567	15
87.66	38.26	64.45	102.71	102.66	104.78	3.572	16
88.88	39.33	81.98	121.31	120.83	123.45	3.558	17
90.48	40.76	99.83	140.59	140.13	142.8	3.559	18
91.75	41.91	118.64	160.55	159.9	162.83	3.555	19
93.38	43.42	137.29	180.71	180.47	183.06	3.562	20
94.75	44.7	156.93	201.63	201.53	204.05	3.564	21
95.52	45.42	178.9	224.32	223.96	226.79	3.561	22
96.13	46.01	201.34	247.36	246.3	249.86	3.553	23
96.68	46.54	224.94	271.47	269.71	274.02	3.545	24
99.24	49.03	240.99	290.02	291.63	292.68	3.577	25
99.72	49.51	265.18	314.7	315.78	317.39	3.572	26
101.31	51.1	285.53	336.63	340.09	339.38	3.591	27
102.1	51.9	309.11	361.02	364.84	363.81	3.594	28
102.83	52.65	333.48	386.12	389.9	388.96	3.593	29
104.04	53.89	355.42	409.31	415.82	412.19	3.61	30
105.21	55.11	378.15	433.26	441.9	436.19	3.623	31
104.56	54.43	409.4	463.83	469.8	466.77	3.608	32
106.13	56.08	429.69	485.77	495.49	488.78	3.627	33
107.25	57.27	451.84	509.11	522.66	512.16	3.646	34
107.54	57.58	478.91	536.48	550.28	539.55	3.647	35
109.44	59.63	497.06	556.69	577.57	559.85	3.677	36
109.93	60.17	523.52	583.69	606.05	586.87	3.683	37
110.44	60.72	549.12	609.84	634.68	613.04	3.693	38
111.7	62.11	570.57	632.68	663.7	635.93	3.716	39
112.47	62.98	593.61	656.59	693.87	659.85	3.738	40
111.82	62.25	625.85	688.1	726.09	691.31	3.74	41
112.81	63.36	646.78	710.14	756.58	713.37	3.767	42
113.8	64.47	667.7	732.17	786.72	735.44	3.792	43
113.8	64.48	694.5	758.98	818.25	762.21	3.806	44

H(M)	D(M)	POISSON'S RATIO
.02379	2.54E-03	.3

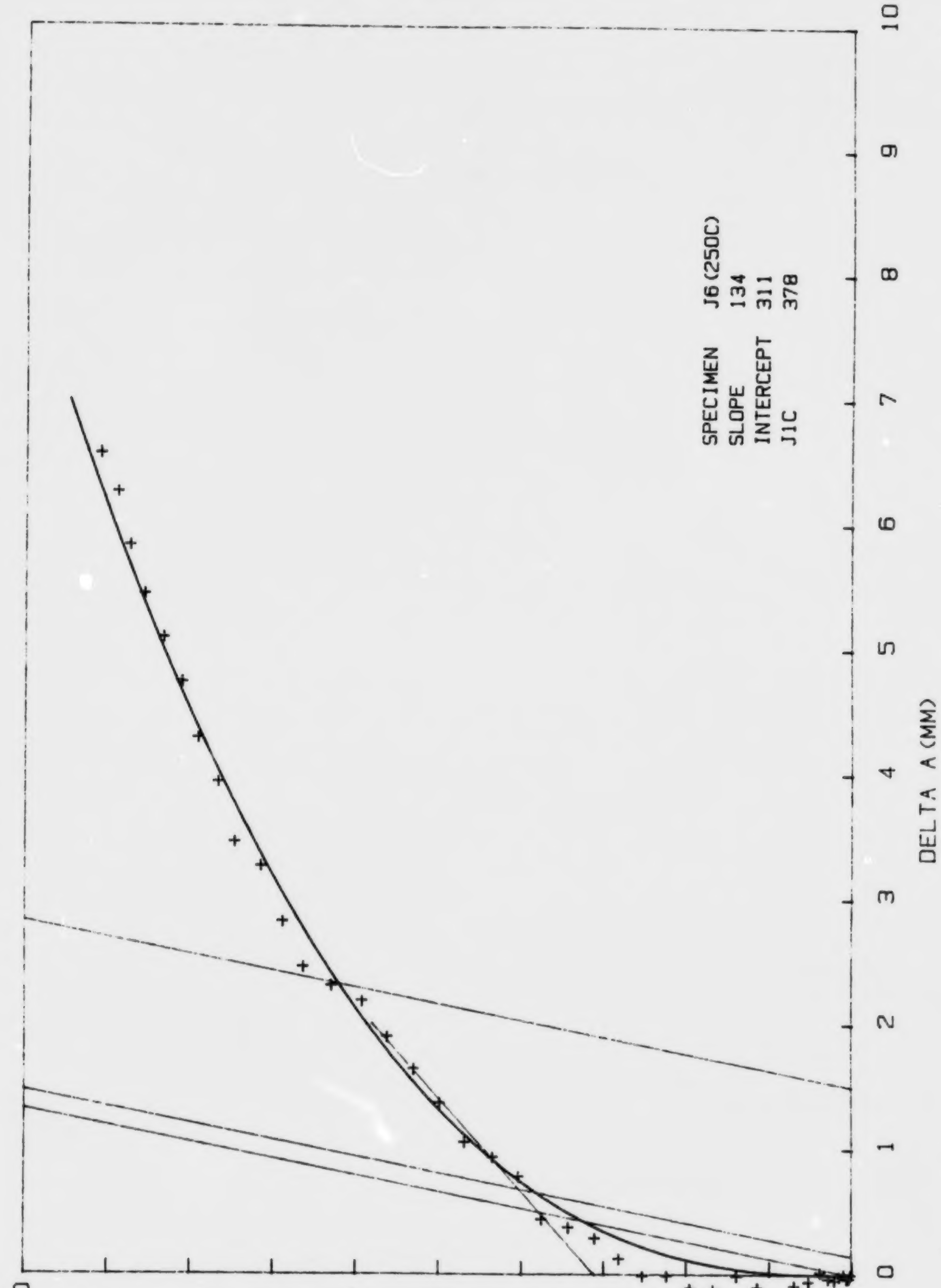
J05

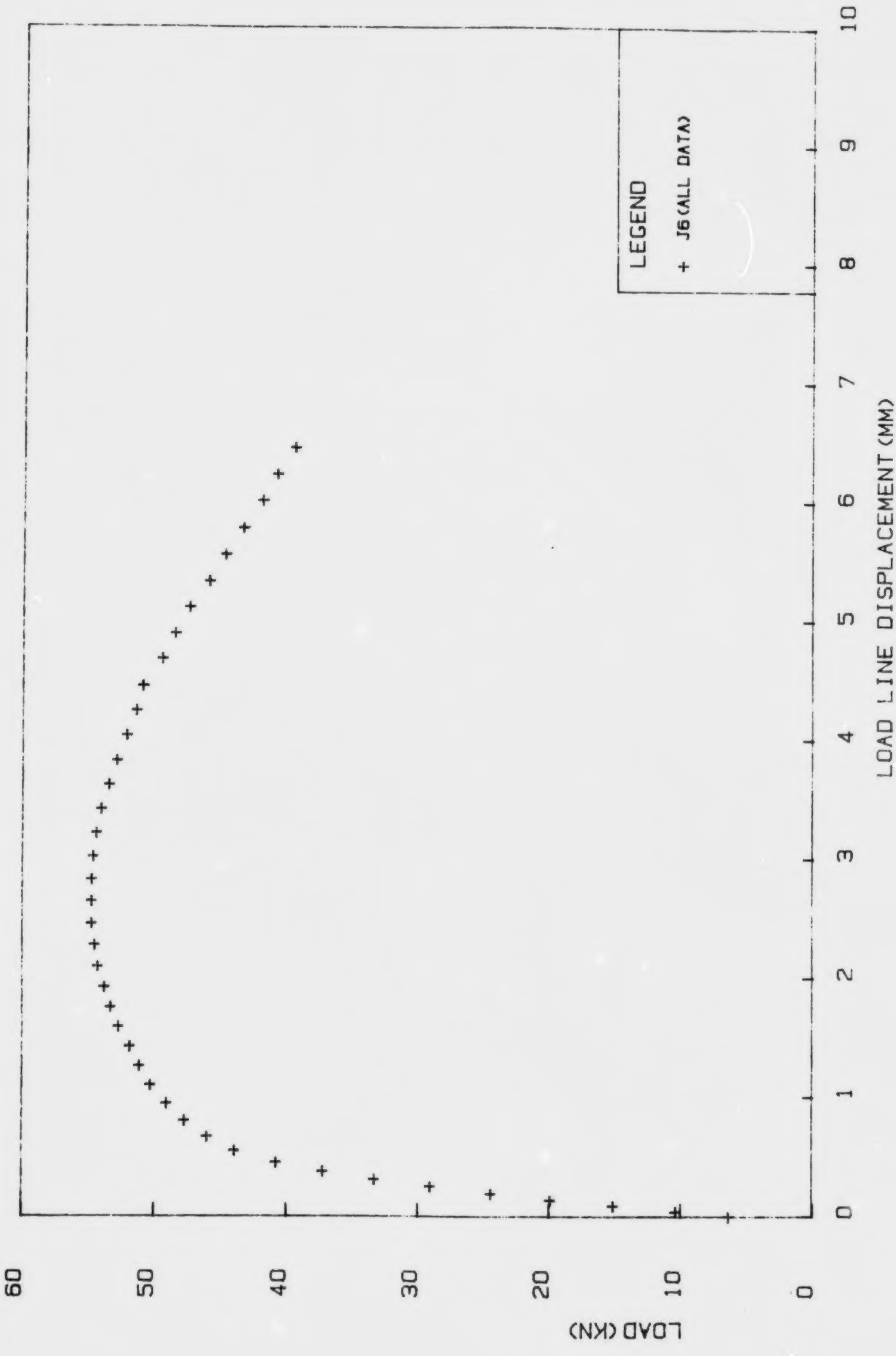
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.1	3.59	3.59	.298	.9993	1
2.14	3.614	3.614	.539	.9999	2
3.75	3.576	3.577	.169	.9998	3
5.76	3.594	3.595	.353	.9999	4
8.26	3.593	3.594	.341	.9997	5
11.29	3.592	3.594	.335	.9999	6
15.01	3.589	3.59	.304	.9999	7
19.15	3.6	3.602	.421	.9997	8
24.52	3.574	3.576	.165	.9996	9
30.42	3.583	3.586	.257	.9998	10
37.57	3.577	3.58	.198	.9997	11
46.75	3.579	3.582	.223	.9998	12
57.74	3.581	3.585	.245	.9997	13
71.58	3.56	3.564	.039	.9999	14
86.29	3.562	3.567	.067	.9998	15
102.71	3.567	3.572	.121	.9997	16
121.31	3.552	3.558	-.017	.9997	17
140.59	3.552	3.559	-.012	.9994	18
160.55	3.547	3.555	-.052	.9994	19
180.71	3.554	3.562	.022	.9995	20
201.63	3.555	3.564	.043	.9997	21
224.32	3.551	3.561	7E-03	.9995	22
247.36	3.542	3.553	-.074	.9992	23
271.47	3.533	3.545	-.148	.9997	24
290.02	3.564	3.577	.169	.9997	25
314.7	3.559	3.572	.123	.9998	26
336.63	3.577	3.591	.311	.9998	27
361.02	3.579	3.594	.337	.9994	28
386.12	3.577	3.593	.334	.9996	29
409.31	3.594	3.61	.504	.9996	30
433.26	3.605	3.623	.629	.9997	31
463.83	3.59	3.608	.483	.9996	32
485.77	3.608	3.627	.673	.9998	33
509.11	3.626	3.646	.857	.9996	34
536.48	3.626	3.647	.868	.9994	35
556.69	3.655	3.677	1.172	.9997	36
583.69	3.661	3.683	1.232	.9997	37
609.84	3.669	3.693	1.328	.9998	38
632.68	3.691	3.716	1.556	.9997	39
656.59	3.713	3.738	1.777	.9994	40
688.1	3.714	3.74	1.801	.9997	41
710.14	3.74	3.767	2.071	.9997	42
732.17	3.764	3.792	2.319	.9997	43
758.98	3.778	3.806	2.459	.9996	44

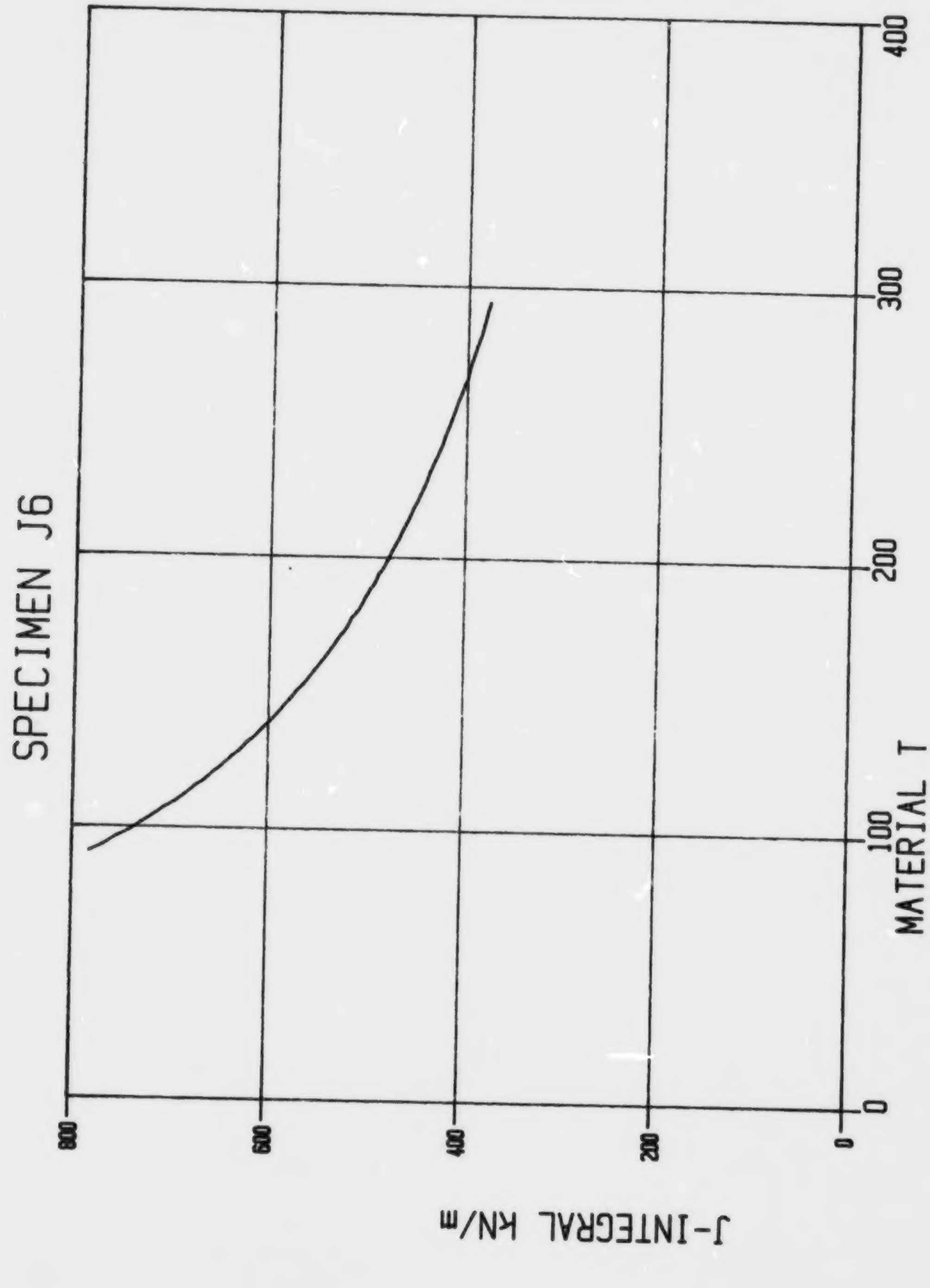
```
            LOAD(KN)       LOAD LINE DISPLACEMENT(MM)      J05
  1          5.615          0
  2          8.423          .028
  3         11.963          .061
  4         15.381          .096
  5         18.921          .134
  6         22.461          .172
  7         26.001          .211
  8         29.419          .253
  9         32.776          .295
 10         35.889          .341
 11         38.879          .391
 12         41.626          .444
 13         44.067          .51
 14         46.143          .585
 15         47.852          .669
 16         49.316          .762
 17         50.598          .863
 18         51.697          .968
 19         52.612          1.08
 20         53.467          1.193
 21         54.199          1.31
 22         54.932          1.427
 23         55.481          1.549
 24         56.091          1.669
 25         56.641          1.793
 26         57.129          1.917
 27         57.556          2.042
 28         57.861          2.173
 29         58.228          2.301
 30         58.655          2.429
 31         58.777          2.565
 32         59.021          2.699
 33         59.143          2.836
 34         59.387          2.969
 35         59.387          3.108
 36         59.509          3.245
 37         59.509          3.386
 38         59.57           3.527
 39         59.509          3.668
 40         59.387          3.815
 41         59.021          3.966
 42         58.594          4.122
 43         58.167          4.277
 44         57.8            4.43
 45         57.312          4.586
```

```
        J(KN/M)            T           W     J05

1         497.44     162.11            6.95
2         522.8      3104.25           126.61
3         546.59     84.83             3.27
4         570.19     568.66            20.98
5         596.77     347.47            12.2
6         621.26     127.65            4.27
7         644.63     137.74            4.4
8         672.34     1679.17           51.42
9         699.12     104.17            3.04
10        721.16     113.04            3.16
11        745.58     245.15            6.6
```


SPECIMEN J6 (250C)
SLOPE 134
INTERCEPT 311
J1C 378
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J6(ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J6
MATERIAL T
J-INTEGRAL kN/m
0
100
200
300
400
0
200
400
600
800

```
      DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

 SPECIMEN NUMBER                                          J06
 MATERIAL TYPE                                            A106B
 MATERIAL CONDITION                                       WELD(PN108)
 TEST TEMPERATURE(DEG C)                                  250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)                275.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)              482
 CRACK PLANE ORIENTATION (PER ASTM E399)                  L-C
 SPECIMEN THICKNESS B(CM)                                 3.048
 PERCENT SIDE GROOVE                                      20.964
 SPECIMEN WIDTH W(CM)                                     6.361
 YOUNGS MODULUS AT TEST TEMP(Pa)                          1.82776E+11
 EFFECTIVE MODULUS(Pa)                                    1.99695147E+11

                  FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                    12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM                 19.54
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                      3.63

                  CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                           3.72
 INITIAL A/W                                              .571
 AVERAGE CRACK EXTENSION 9PT(CM)                          .697
 DELTA A(CM) COMPLIANCE                                   .657
 MAX DEVIATION OF SINGLE MEASUREMENT %                    .51

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                         22
 LAST POINT                          29
 JIC(KN/M)                           378
 CORRELATION COEFF                   .98
 SLOPE M(MPa)                        134
 INTERCEPT B (KN/M)                  311

                  VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD            NO
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD               YES

                  QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                                 NO
 CRACK SIZE DA<0.15*DELTA A                               YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                          456.08
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                        392.75
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                         2.731
 25*JQ/EF.Y.(CM)                                          2.496

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED           22
 LAST DATA POINT USED          41
 CONSTANT(C1)                  450.01
 EXPONENT(C2)                  .3831
```

J6(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
18.56	1.72	.02	1.74	1.74	1.84	3.63	1
27.04	3.64	.1	3.74	3.74	3.95	3.627	2
35.53	6.29	.05	6.34	6.34	6.69	3.627	3
43.69	9.5	.83	10.34	10.34	10.88	3.631	4
51.93	13.43	2	15.42	15.42	16.19	3.629	5
59.47	17.61	3.79	21.39	21.39	22.4	3.626	6
66.49	22.01	6.97	28.98	28.98	30.23	3.627	7
73.02	26.55	12.04	38.59	38.61	40.1	3.632	8
78.36	30.57	21.98	52.55	52.52	54.3	3.624	9
81.9	33.4	36.89	70.29	70.22	72.2	3.621	10
84.13	35.24	56.87	92.12	91.75	94.18	3.604	11
87.26	37.91	76.61	114.52	114.57	116.68	3.62	12
89.92	40.25	99.25	139.5	139.91	141.76	3.629	13
90.85	41.1	126.45	167.55	167.41	169.91	3.618	14
92.21	42.33	153.43	195.76	195.68	198.18	3.619	15
94.28	44.26	179.53	223.79	224.49	226.28	3.629	16
95.37	45.28	207.79	253.07	253.76	255.62	3.629	17
97	46.85	234.78	281.63	283.71	284.2	3.643	18
98.79	48.59	262.35	310.94	314.87	313.54	3.659	19
99.74	49.53	293.49	343.02	348.07	345.63	3.668	20
100.56	50.34	325.3	375.64	381.6	378.27	3.674	21
102.58	52.38	351.26	403.65	415.05	406.25	3.708	22
103.51	53.34	381.79	435.13	449.21	437.71	3.723	23
104.02	53.87	415.3	469.16	485.52	471.71	3.735	24
105.51	55.43	443.6	499.03	521.9	501.51	3.767	25
106.53	56.5	473.74	530.24	559.13	532.65	3.794	26
107	57.01	505.27	562.27	597.37	564.57	3.819	27
107.68	57.73	535.08	592.82	635.36	595	3.848	28
107.01	57.01	572.57	629.58	675.49	631.63	3.86	29
106.49	56.46	607.4	663.86	714.19	665.77	3.875	30
107.95	58.02	631.13	689.15	751	691.02	3.911	31
107.91	57.97	657.64	715.61	792.22	717.25	3.956	32
107.12	57.13	690.3	747.44	830.81	748.89	3.975	33
108.12	58.2	709.09	767.29	868.55	768.65	4.023	34
107.32	57.35	733.99	791.34	906.3	792.48	4.058	35
107.76	57.81	753.25	811.06	944.13	812.07	4.103	36
107.19	57.21	776.26	833.46	981.65	834.27	4.139	37
106.21	56.16	800.44	856.6	1020.23	857.15	4.174	38
106.44	56.41	818	874.41	1056.17	874.84	4.213	39
106.28	56.23	833.4	889.64	1091.81	889.94	4.256	40
105.45	55.36	855.15	910.51	1128.04	910.6	4.287	41

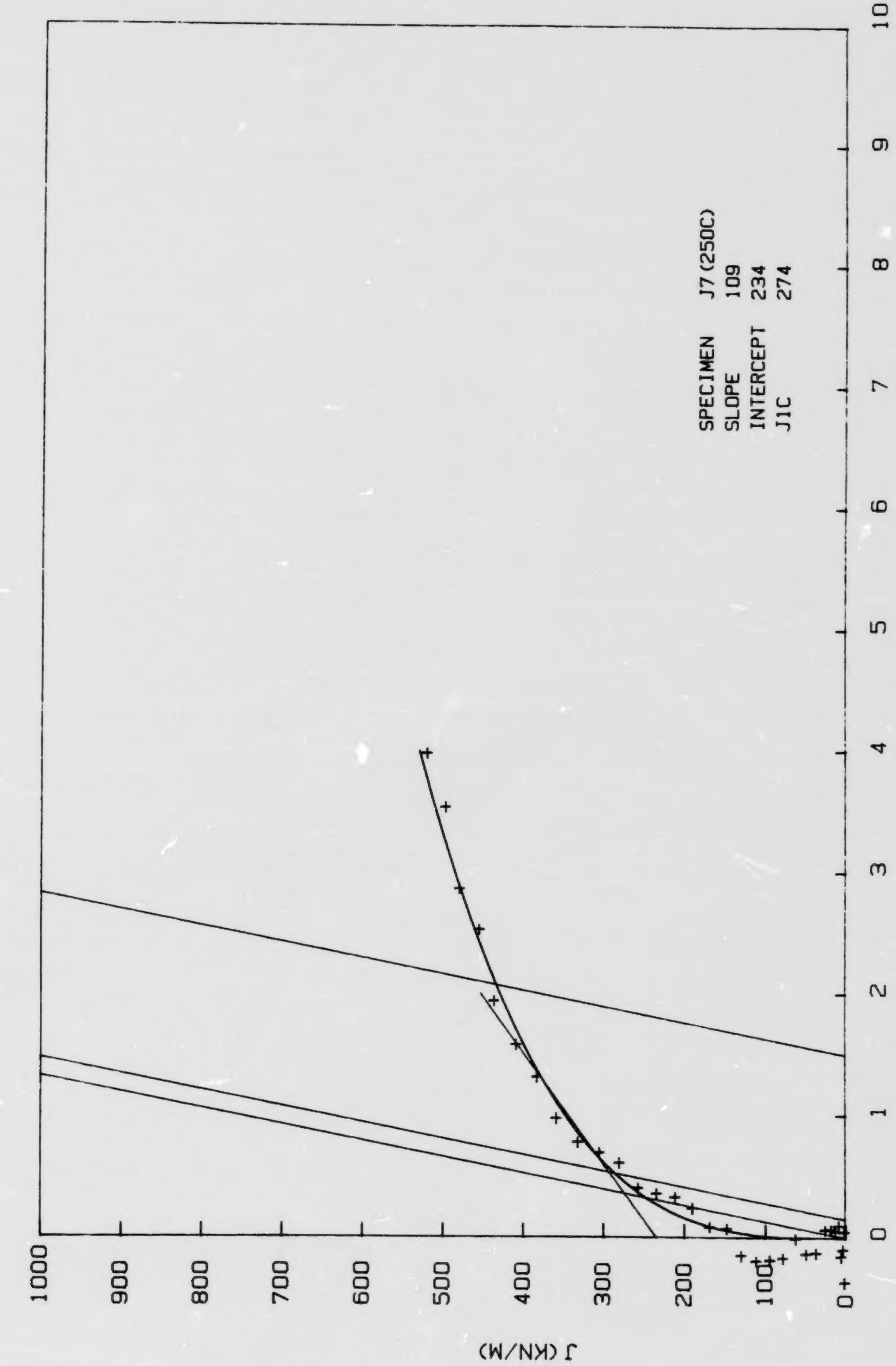
H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

J06

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.74	3.63	3.63	3E-03	.9996	1
3.74	3.627	3.627	-.026	.9996	2
6.34	3.626	3.627	-.031	.9996	3
10.34	3.63	3.631	8E-03	.9996	4
15.42	3.627	3.629	-.012	.9999	5
21.39	3.624	3.626	-.043	.9997	6
28.98	3.625	3.627	-.029	.9994	7
38.59	3.629	3.632	.022	.9999	8
52.55	3.621	3.624	-.056	.9999	9
70.29	3.617	3.621	-.09	.9999	10
92.12	3.599	3.604	-.259	.9999	11
114.52	3.614	3.62	-.105	.9997	12
139.5	3.622	3.629	-9E-03	.9999	13
167.55	3.61	3.618	-.123	.9998	14
195.76	3.61	3.619	-.113	.9997	15
223.79	3.619	3.629	-9E-03	.9999	16
253.07	3.618	3.629	-.01	.9999	17
281.63	3.631	3.643	.128	.9998	18
310.94	3.646	3.659	.289	.9998	19
343.02	3.653	3.668	.377	.9998	20
375.64	3.659	3.674	.44	.9997	21
403.65	3.692	3.708	.78	.9999	22
435.13	3.706	3.723	.934	.9995	23
469.16	3.717	3.735	1.054	.9997	24
499.03	3.747	3.767	1.367	.9999	25
530.24	3.773	3.794	1.636	.9999	26
562.27	3.798	3.819	1.894	1	27
592.82	3.825	3.848	2.18	.9998	28
629.58	3.836	3.86	2.302	.9998	29
663.86	3.85	3.875	2.451	.9998	30
689.15	3.885	3.911	2.814	.9999	31
715.61	3.929	3.956	3.257	.9999	32
747.44	3.947	3.975	3.45	.9998	33
767.29	3.995	4.023	3.931	.9998	34
791.34	4.029	4.058	4.284	.9998	35
811.06	4.073	4.103	4.729	.9998	36
833.46	4.108	4.139	5.086	.9998	37
856.6	4.142	4.174	5.436	.9998	38
874.41	4.181	4.213	5.828	.9999	39
889.64	4.223	4.256	6.255	.9996	40
910.51	4.254	4.287	6.565	.9996	41

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J06
1	6.348	0	
2	10.376	.042	
3	15.137	.09	
4	19.897	.137	
5	24.414	.193	
6	29.053	.251	
7	33.325	.31	
8	37.231	.376	
9	40.771	.452	
10	43.945	.549	
11	46.021	.667	
12	47.729	.801	
13	49.072	.945	
14	50.293	1.099	
15	51.147	1.257	
16	51.88	1.421	
17	52.734	1.587	
18	53.345	1.75	
19	53.833	1.919	
20	54.321	2.092	
21	54.565	2.273	
22	54.81	2.454	
23	54.81	2.639	
24	54.81	2.822	
25	54.688	3.015	
26	54.443	3.213	
27	54.077	3.413	
28	53.467	3.618	
29	52.856	3.823	
30	52.124	4.036	
31	51.392	4.243	
32	50.903	4.448	
33	49.438	4.68	
34	48.462	4.893	
35	47.363	5.112	
36	45.898	5.33	
37	44.678	5.554	
38	43.335	5.776	
39	41.87	6.008	
40	40.771	6.23	
41	39.429	6.455	
42	38.208	6.682	

	J(KN/M)	T	W	J06
1	389.64	104.97	5.61	
2	419.39	261.86	12.92	
3	452.15	361.17	16.45	
4	484.1	121.52	5.11	
5	514.63	147.94	5.79	
6	546.25	158.64	5.79	
7	577.54	135.68	4.63	
8	611.2	384.5	12.34	
9	646.72	294.69	8.89	
10	676.51	88.7	2.52	
11	702.38	76.13	2.05	
12	731.53	210.8	5.39	
13	757.36	52.6	1.27	
14	779.32	86.9	2.01	
15	801.2	56.41	1.25	
16	822.26	80.01	1.7	
17	845.03	84.43	1.71	
18	865.5	57.81	1.13	
19	882.02	45.5	.85	
20	900.07	85.83	1.55	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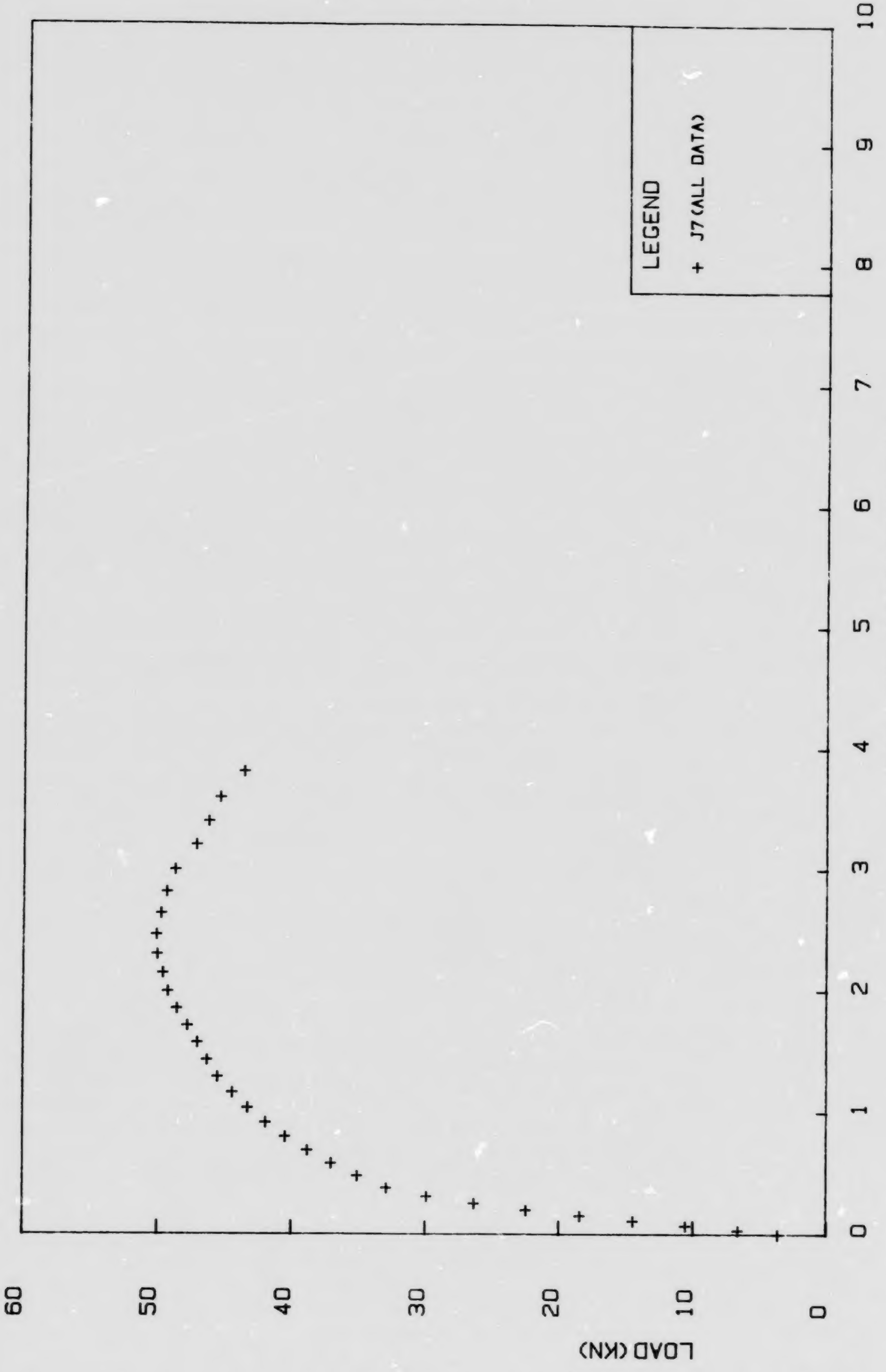
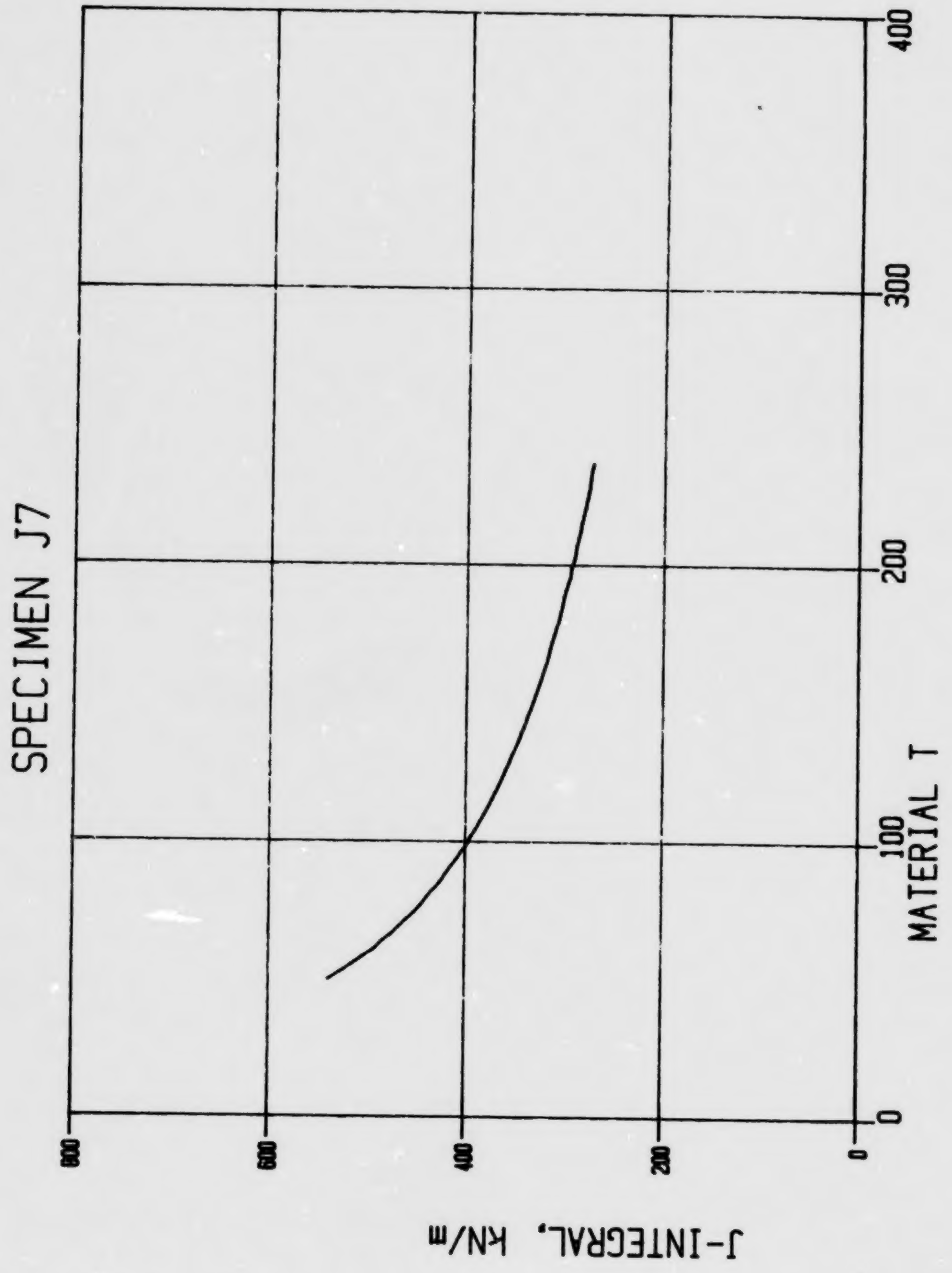
SLOPE 109
INTERCEPT 234
J1C 274
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J7(ALL DATA)


SPECIMEN J7
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                    TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J7
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   HAZ(PN108)
 TEST TEMPERATURE(DEG C)                              250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            275.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          482
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             3.053
 PERCENT SIDE GROOVE                                  21.388
 SPECIMEN WIDTH W(CM)                                 6.36
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
 EFFECTIVE MODULUS(Pa)                                2.07551516E+11

                    FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             19.38
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.618

                    CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.716
 INITIAL A/W                                          .569
 AVERAGE CRACK EXTENSION 9PT(CM)                      .548
 DELTA A(CM) COMPLIANCE                               .398
 MAX DEVIATION OF SINGLE MEASUREMENT %                .539

                    ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     22
 LAST POINT                      28
 JIC(KN/M)                       274
 CORRELATION COEFF               .95
 SLOPE M(MPa)                    109
 INTERCEPT B (KN/M)              234

                    VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

                    QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           NO
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      454.38
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    443.85
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.742
 25*JQ/EF.Y.(CM)                                      1.809

                    CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        22
 LAST DATA POINT USED       32
 CONSTANT(C1)               347.44
 EXPONENT(C2)               .3047
```

J7(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
11.6	.67	.03	.7	.7	.76	3.581	1
18.84	1.77	-.03	1.74	1.74	1.84	3.623	2
25.59	3.26	.12	3.38	3.38	3.58	3.608	3
32.51	5.26	.38	5.65	5.65	5.96	3.603	4
40.19	8.04	.62	8.66	8.67	9.12	3.628	5
47.05	11.02	1.84	12.86	12.87	13.5	3.623	6
53.42	14.21	3.92	18.13	18.13	18.95	3.625	7
58.74	17.18	8.31	25.5	25.5	26.49	3.624	8
62	19.14	17.8	36.94	36.87	38.09	3.605	9
65.42	21.31	28.14	49.44	49.36	50.71	3.605	10
69.03	23.73	38.93	62.65	62.75	64.04	3.617	11
71.32	25.32	52.87	78.19	77.98	79.7	3.601	12
73.83	27.14	67.26	94.39	94.14	96.01	3.599	13
76.16	28.88	82.58	111.46	111.18	113.18	3.599	14
78.4	30.6	99.19	129.79	129.7	131.6	3.603	15
81.35	32.95	114.56	147.51	148.46	149.39	3.625	16
82.83	34.16	134.65	168.8	169.83	170.76	3.627	17
84.88	35.87	154.25	190.12	192.15	192.12	3.642	18
86.66	37.39	173.99	211.38	214.11	213.45	3.651	19
88.24	38.77	195.54	234.3	237.27	236.45	3.654	20
89.69	40.05	217.13	257.17	260.57	259.38	3.658	21
91.44	41.63	238.89	280.52	286.11	282.76	3.679	22
92.69	42.77	262.45	305.22	311.81	307.49	3.688	23
93.27	43.32	288.6	331.91	339.63	334.18	3.696	24
93.65	43.66	315.1	358.76	369.22	360.96	3.716	25
94.72	44.67	338.42	383.09	398.84	385.23	3.749	26
95.06	44.99	364.32	409.31	429.6	411.35	3.776	27
94.01	44	392.68	436.68	463.61	438.46	3.812	28
95.61	45.51	409.85	455.36	494.05	457.06	3.87	29
95.87	45.76	434.14	479.9	525.78	481.45	3.904	30
96.24	46.11	451.18	497.29	558.52	498.66	3.971	31
95.24	45.16	475.23	520.39	592.39	521.47	4.016	32

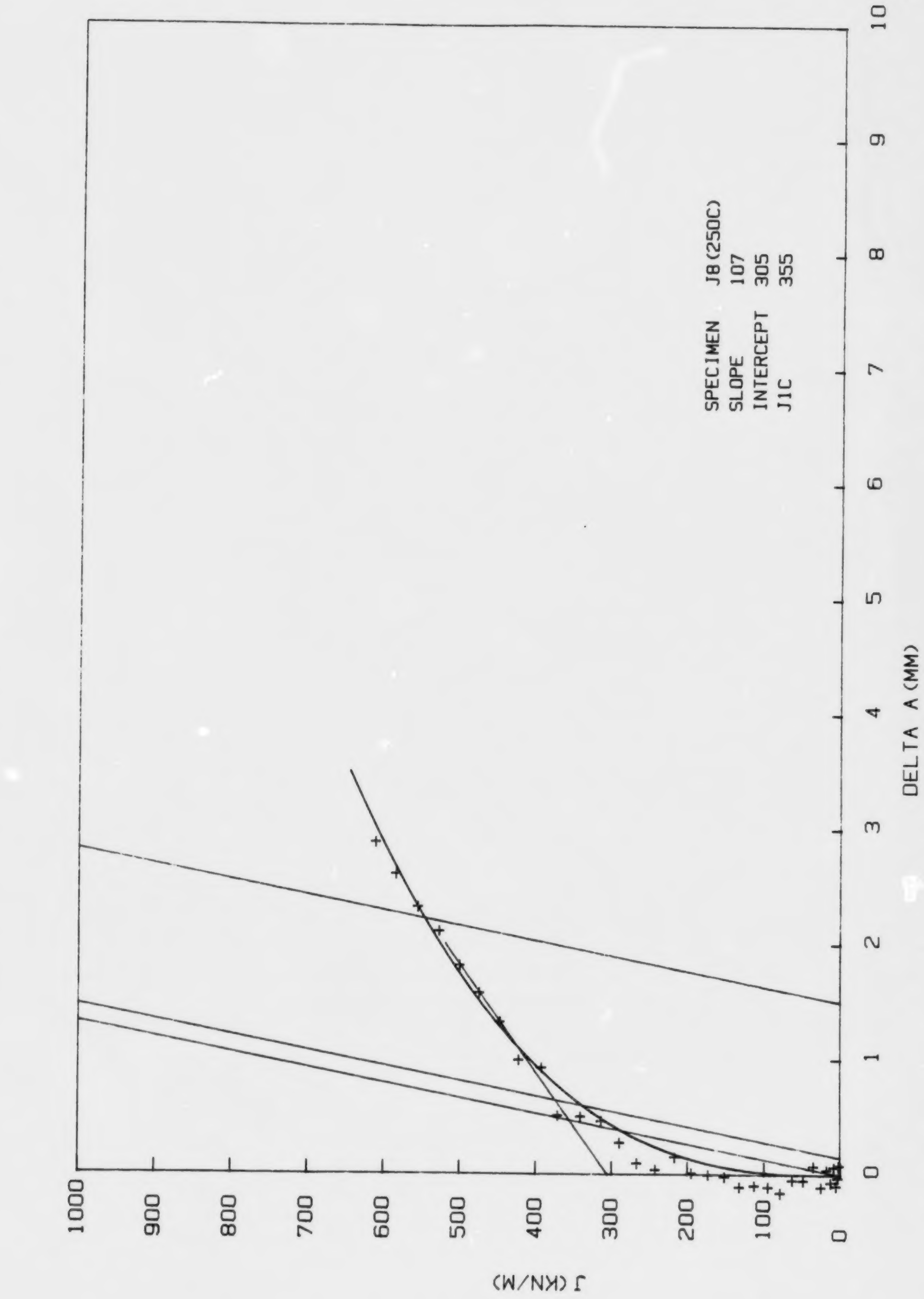
H(M)	D(M)	POISSON'S RATIO
.02382	2.54E-03	.3

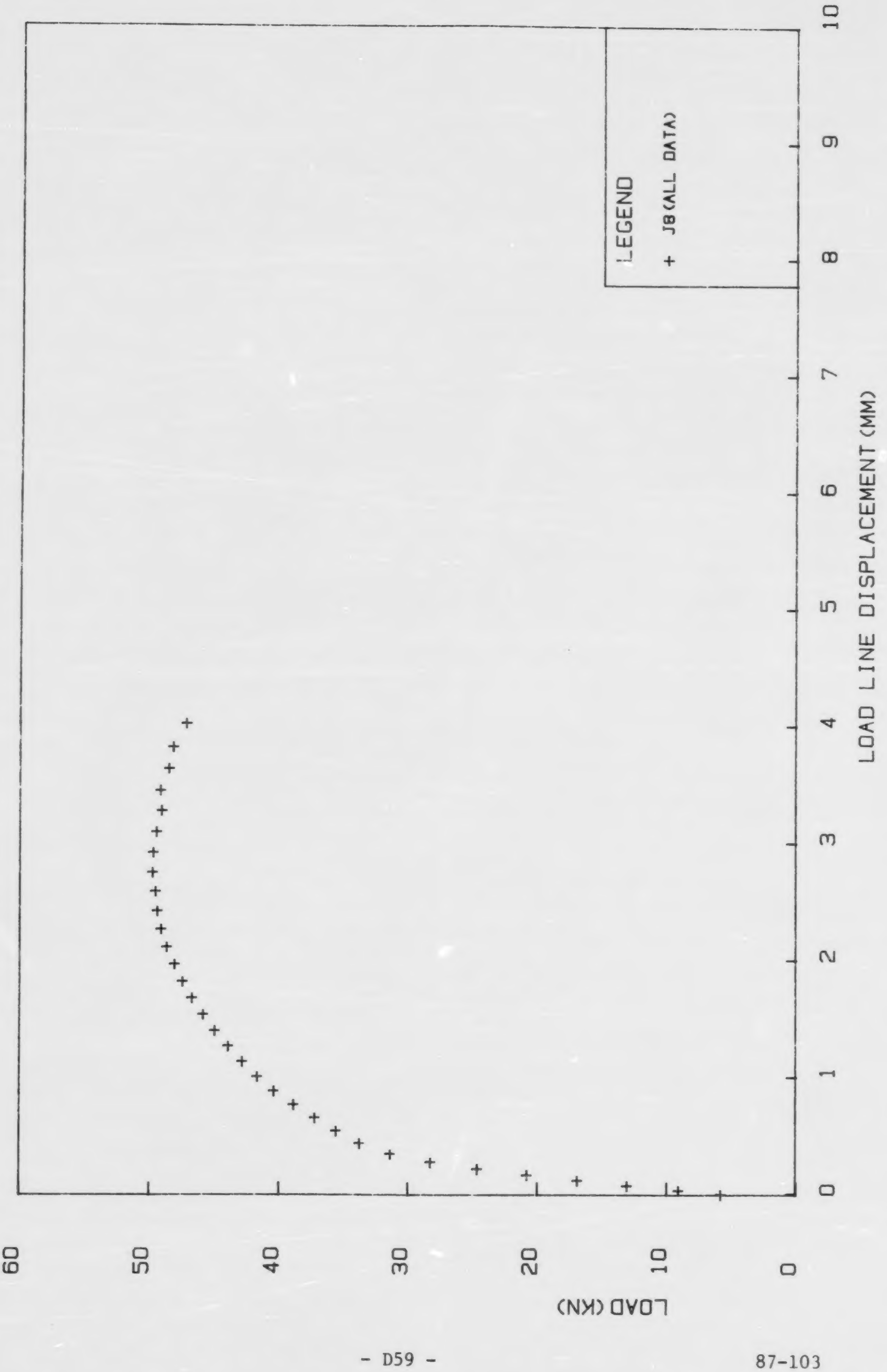
J7

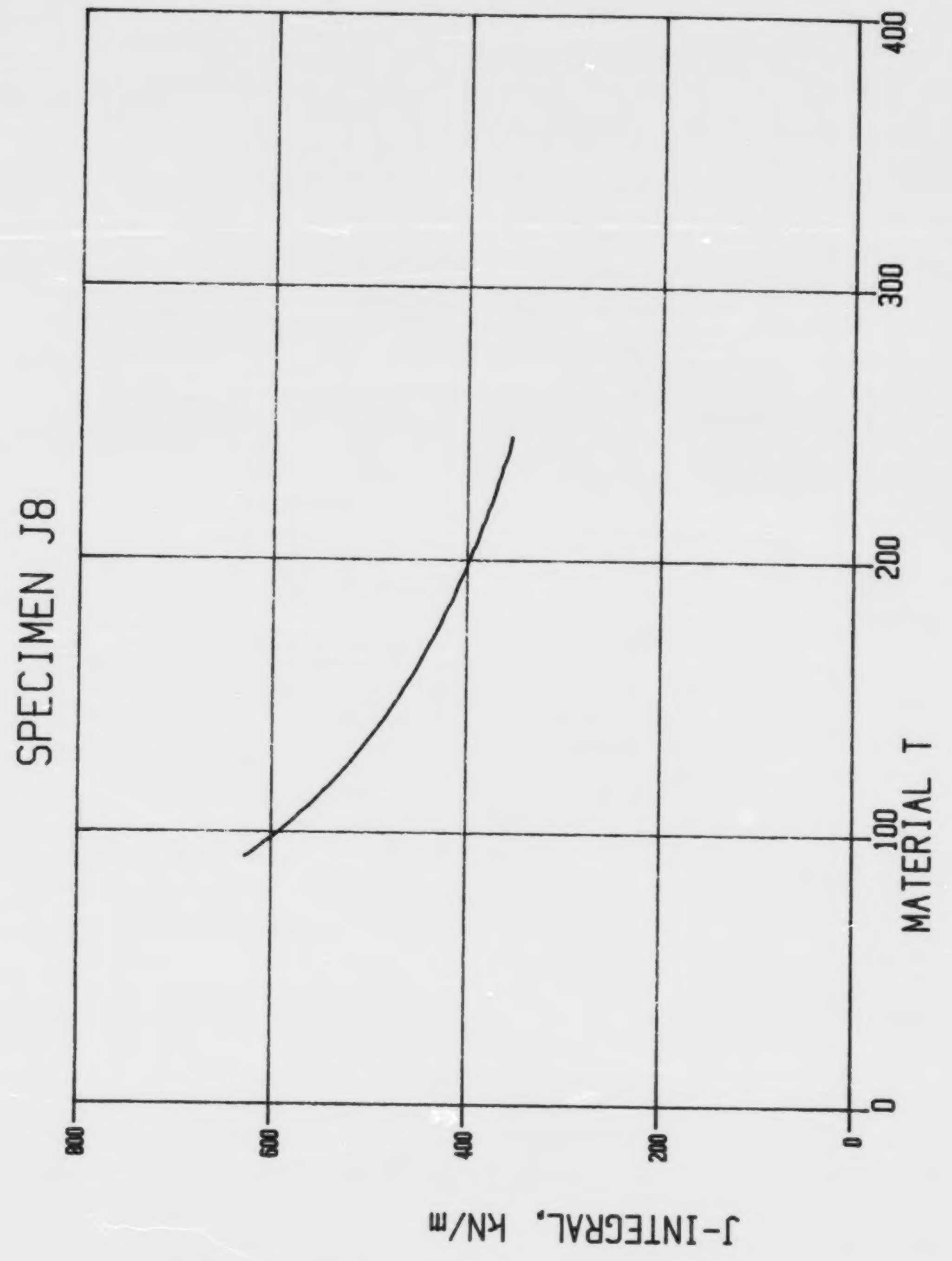
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.7	3.581	3.581	-.365	.9997	1
1.74	3.623	3.623	.05	.9998	2
3.38	3.608	3.608	-.098	.9997	3
5.65	3.602	3.603	-.154	.9997	4
8.66	3.627	3.628	.098	.9998	5
12.86	3.622	3.623	.051	.9994	6
18.13	3.623	3.625	.069	.9999	7
25.5	3.622	3.624	.064	.9997	8
36.94	3.603	3.605	-.125	.9998	9
49.44	3.601	3.605	-.134	.9999	10
62.65	3.613	3.617	-8E-03	.9994	11
78.19	3.596	3.601	-.168	.9999	12
94.39	3.594	3.599	-.185	.9996	13
111.46	3.592	3.599	-.192	.9996	14
129.79	3.596	3.603	-.147	.9999	15
147.51	3.617	3.625	.073	.9995	16
168.8	3.618	3.627	.086	.9999	17
190.12	3.632	3.642	.24	.9995	18
211.38	3.64	3.651	.332	.9997	19
234.3	3.642	3.654	.36	.9998	20
257.17	3.646	3.658	.405	.9997	21
280.52	3.666	3.679	.611	.9997	22
305.22	3.673	3.688	.696	.9999	23
331.91	3.681	3.696	.783	.9999	24
358.76	3.699	3.716	.975	.9997	25
383.09	3.732	3.749	1.313	.9999	26
409.31	3.758	3.776	1.579	.9999	27
436.68	3.793	3.812	1.939	.9996	28
455.36	3.851	3.87	2.525	.9998	29
479.9	3.883	3.904	2.861	.9999	30
497.29	3.95	3.971	3.532	.9999	31
520.39	3.994	4.016	3.976	.9999	32

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J7
1	3.601	0	
2	6.653	.032	
3	10.559	.071	
4	14.465	.111	
5	18.433	.154	
6	22.461	.201	
7	26.367	.254	
8	29.907	.311	
9	32.898	.382	
10	35.095	.48	
11	37.048	.583	
12	38.818	.691	
13	40.466	.803	
14	41.931	.92	
15	43.274	1.04	
16	44.434	1.167	
17	45.532	1.295	
18	46.326	1.433	
19	47.058	1.577	
20	47.791	1.715	
21	48.584	1.857	
22	49.255	1.997	
23	49.622	2.152	
24	50.049	2.303	
25	50.11	2.466	
26	49.744	2.64	
27	49.316	2.819	
28	48.706	3.002	
29	47.119	3.208	
30	46.204	3.402	
31	45.349	3.597	
32	43.579	3.811	
33	41.87	4.028	

	J(KN/M)	T	W	J7
1	268.85	144.12	11.27	
2	292.87	370.73	26.54	
3	318.57	390.79	25.63	
4	345.33	178	10.69	
5	370.92	92.01	5.08	
6	396.2	125.31	6.41	
7	423	96.93	4.58	
8	446.02	40.69	1.78	
9	467.63	92.93	3.83	
10	488.6	33.05	1.27	
11	508.84	66.35	2.4	


SPECIMEN JB(250C)
SLOPE 107
INTERCEPT 305
J1C 355
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ JB(ALL DATA)
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LOAD (KN)
0
10
20
30
40
50
60


SPECIMEN J8
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
    DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

SPECIMEN NUMBER                                      J8
MATERIAL TYPE                                        A106B
MATERIAL CONDITION                                   HAZ(PN108)
TEST TEMPERATURE(DEG C)                              250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            275.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          482
CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
SPECIMEN THICKNESS B(CM)                             2.901
PERCENT SIDE GROOVE                                  21.268
SPECIMEN WIDTH W(CM)                                 6.297
YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
EFFECTIVE MODULUS(Pa)                                2.04659641E+11

                FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             20.63
INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.593

                CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                       3.717
INITIAL A/W                                          .571
AVERAGE CRACK EXTENSION 9PT(CM)                      .315
DELTA A(CM) COMPLIANCE                               .288
MAX DEVIATION OF SINGLE MEASUREMENT %                .79

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                     25
LAST POINT                      33
JIC(KN/M)                       355
CORRELATION COEFF               .99
SLOPE M(MPa)                    107
INTERCEPT B (KN/M)              305

                VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD        NO
LIGAMENT>25JIC/EFFECTIVE YIELD  YES
DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                             NO
CRACK SIZE DA<0.15*DELTA A                           YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      432.42
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    457.41
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.704
25*JQ/EF.Y.(CM)                                      2.344

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED        25
LAST DATA POINT USED       33
CONSTANT(C1)               408.32
EXPONENT(C2)               .3654
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J8(250C)

K MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
17.29	1.49	.01	1.5	1.5	1.58	3.601	1
24.68	3.03	0	3.03	3.03	3.2	3.591	2
31.82	5.04	.33	5.37	5.37	5.66	3.584	3
39.53	7.78	.51	8.29	8.29	8.73	3.6	4
46.48	10.76	1.74	12.5	12.5	13.12	3.587	5
53.6	14.31	3.47	17.77	17.78	18.59	3.597	6
59	17.33	7.92	25.26	25.24	26.27	3.582	7
64.14	20.48	14.84	35.33	35.38	36.5	3.601	8
67.14	22.44	26.34	48.79	48.75	50.09	3.588	9
70.26	24.58	38.62	63.2	63.16	64.63	3.588	10
72.9	26.46	52.57	79.04	78.79	80.6	3.577	11
75.99	28.75	66.22	94.97	94.86	96.65	3.583	12
78.45	30.64	82.32	112.96	112.88	114.75	3.584	13
80.57	32.32	99.9	132.22	132.08	134.11	3.582	14
83.07	34.35	117.43	151.78	152.09	153.76	3.591	15
85.11	36.06	136.78	172.84	173.24	174.92	3.593	16
86.91	37.61	157.38	194.99	195.49	197.15	3.594	17
89.23	39.64	177.22	216.86	218.42	219.1	3.608	18
90.06	40.38	201.86	242.24	242.84	244.56	3.597	19
91.51	41.69	224.98	266.68	267.84	269.06	3.603	20
93.63	43.65	246.01	289.66	292.78	292.1	3.62	21
95.49	45.4	268.17	313.57	318.98	316.06	3.639	22
96.3	46.17	294.69	340.86	346.75	343.38	3.643	23
96.58	46.44	324.55	371	377.02	373.53	3.644	24
99.48	49.27	342.9	392.17	404.89	394.76	3.685	25
99.76	49.55	372.8	422.34	436.23	424.91	3.692	26
101.28	51.07	396.14	447.21	467.33	449.75	3.725	27
101.96	51.76	422.86	474.62	499.83	477.1	3.75	28
103.72	53.56	447.01	500.57	530.91	503.07	3.774	29
104.22	54.08	473.54	527.62	564.82	530.01	3.804	30
104.96	54.85	501.14	555.99	598.42	558.33	3.825	31
104.6	54.48	530.45	584.93	634.92	587.09	3.854	32
105.1	55	556.67	611.66	669.36	613.72	3.881	33

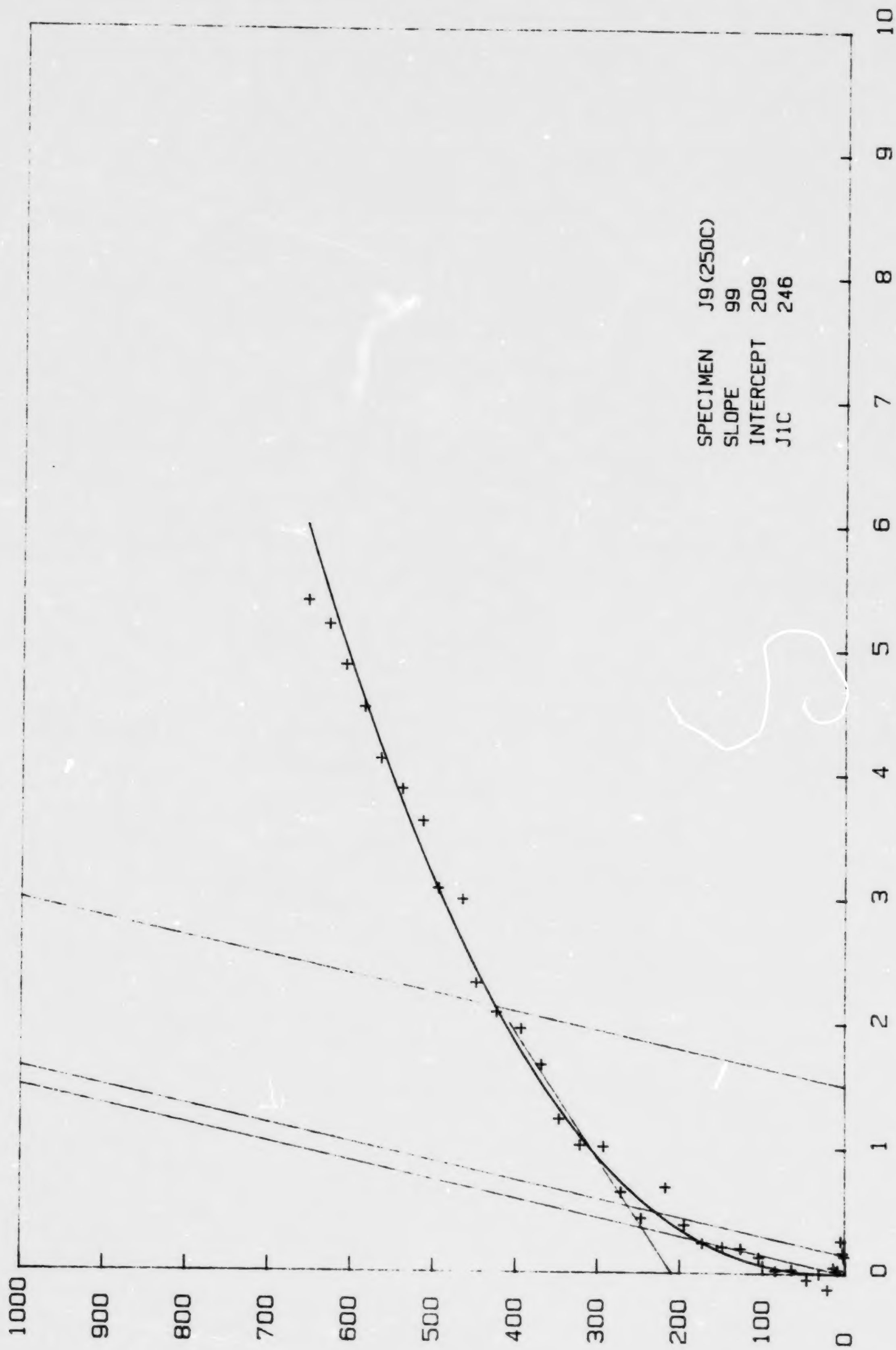
H(M)	D(M)	POISSON'S RATIO
.02384	2.54E-03	.3

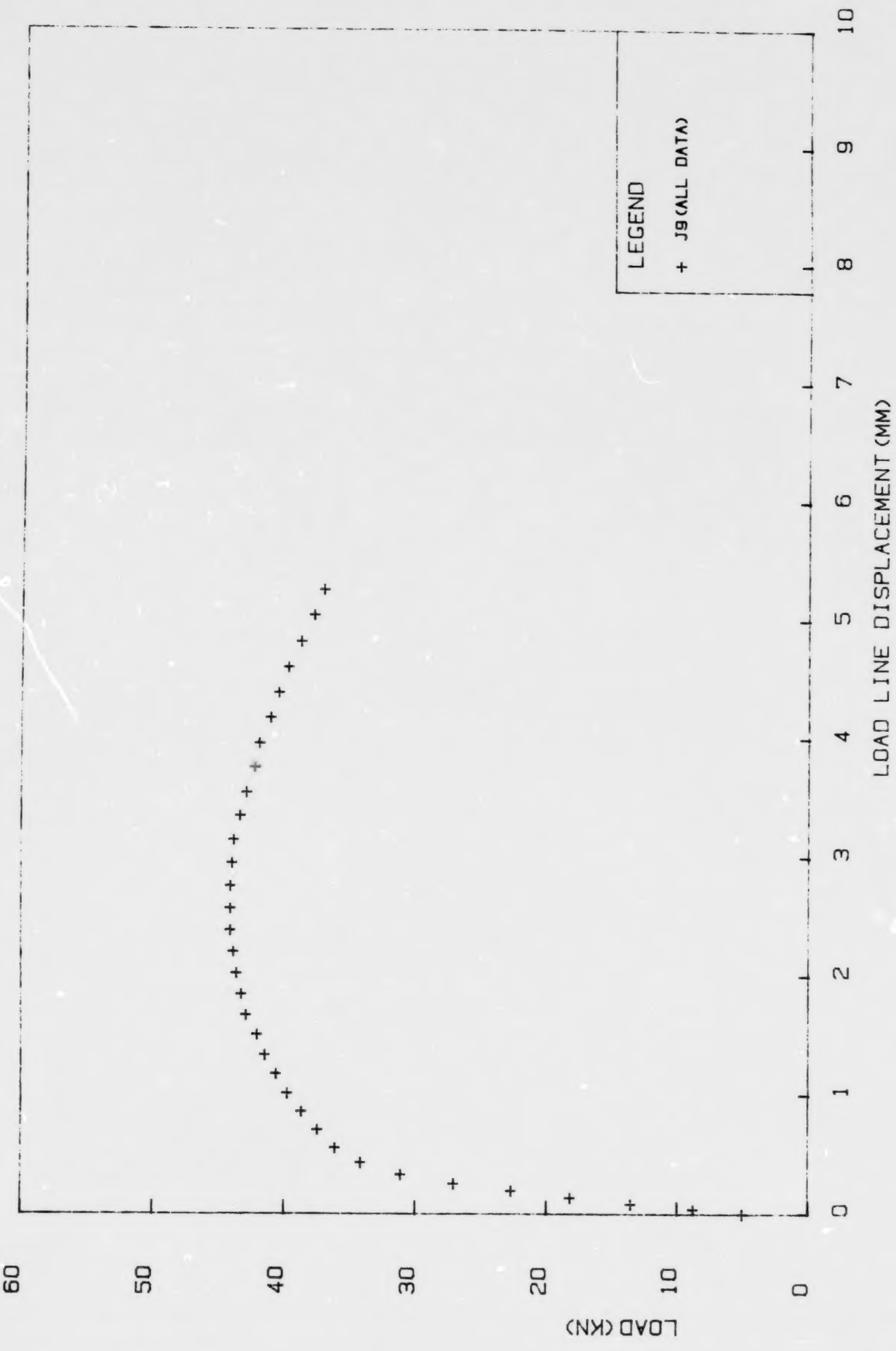
J8

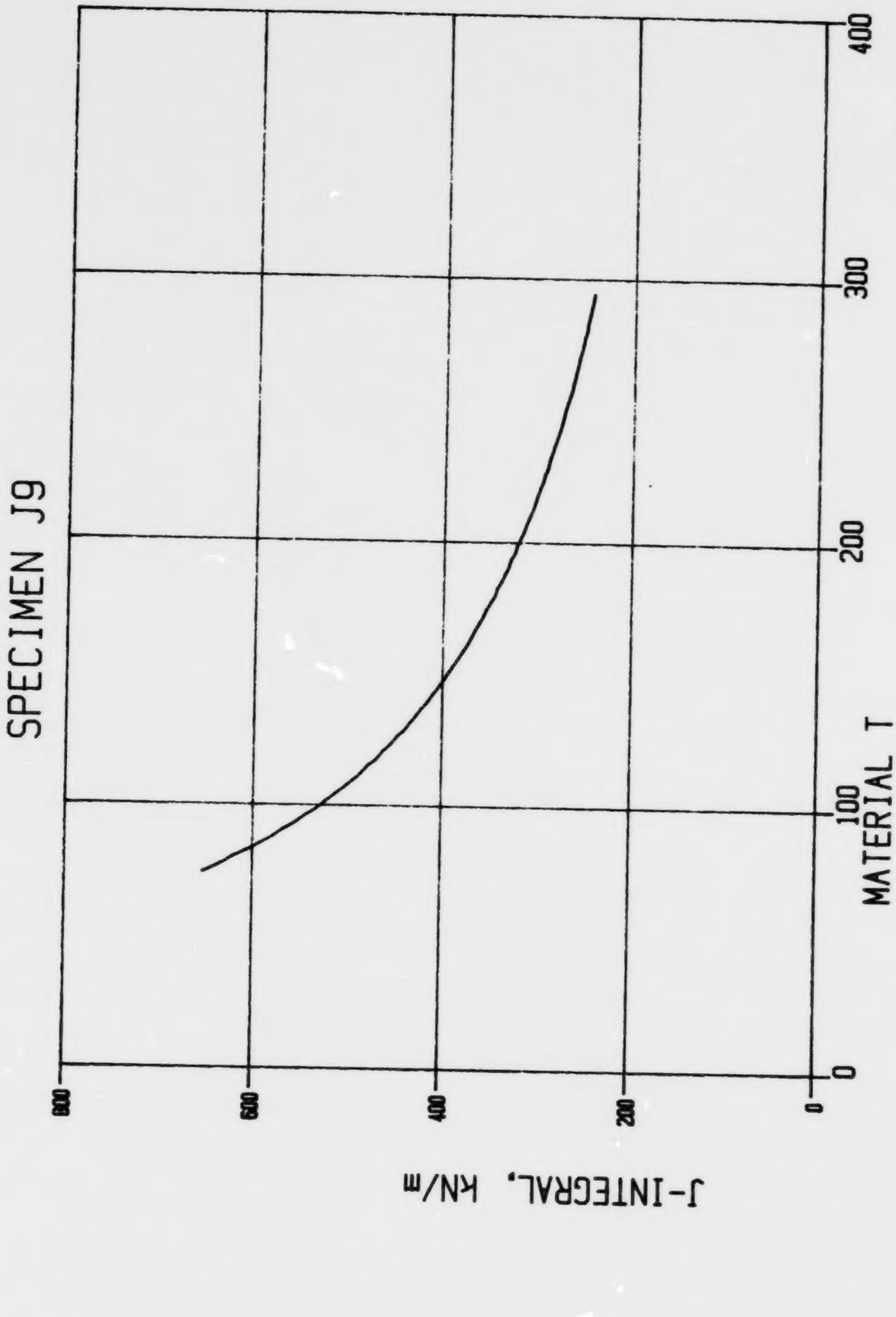
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.5	3.601	3.601	.083	.9996	1
3.03	3.59	3.591	-.023	.9997	2
5.37	3.583	3.584	-.093	.9996	3
8.29	3.599	3.6	.068	.9994	4
12.5	3.585	3.587	-.065	.9997	5
17.77	3.596	3.597	.043	.9995	6
25.26	3.58	3.582	-.105	.9994	7
35.33	3.598	3.601	.076	.9998	8
48.79	3.585	3.588	-.048	.9995	9
63.2	3.584	3.588	-.045	.9999	10
79.04	3.572	3.577	-.157	.9997	11
94.97	3.577	3.583	-.105	.9998	12
112.96	3.577	3.584	-.094	.9999	13
132.22	3.575	3.582	-.108	.9999	14
151.78	3.583	3.591	-.017	.9998	15
172.84	3.584	3.593	-1E-03	.9998	16
194.99	3.585	3.594	.013	.9999	17
216.86	3.597	3.608	.15	.9997	18
242.24	3.585	3.597	.041	.9997	19
266.68	3.59	3.603	.097	.9999	20
289.66	3.607	3.62	.275	.9999	21
313.57	3.625	3.639	.462	.9998	22
340.86	3.628	3.643	.499	.9997	23
371	3.627	3.644	.508	.9999	24
392.17	3.668	3.685	.923	1	25
422.34	3.674	3.692	.99	.9997	26
447.21	3.706	3.725	1.322	.9999	27
474.62	3.73	3.75	1.574	.9998	28
500.57	3.753	3.774	1.81	.9998	29
527.62	3.782	3.804	2.107	.9998	30
555.99	3.802	3.825	2.318	.9998	31
584.93	3.83	3.854	2.605	.9998	32
611.66	3.856	3.881	2.88	.9999	33

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J8
1	5.798	0	
2	9.094	.035	
3	13.062	.076	
4	16.907	.121	
5	20.813	.167	
6	24.658	.22	
7	28.259	.278	
8	31.372	.348	
9	33.752	.438	
10	35.583	.544	
11	37.231	.656	
12	38.879	.769	
13	40.405	.884	
14	41.687	1.007	
15	42.847	1.134	
16	43.945	1.265	
17	44.983	1.398	
18	45.898	1.534	
19	46.753	1.675	
20	47.485	1.816	
21	48.096	1.963	
22	48.706	2.109	
23	49.133	2.261	
24	49.438	2.416	
25	49.561	2.583	
26	49.805	2.745	
27	49.744	2.916	
28	49.5	3.092	
29	49.072	3.273	
30	49.194	3.445	
31	48.523	3.633	
32	48.218	3.817	
33	47.18	4.02	
34	46.57	4.213	

	J(KN/M)	T	W	J8
1	355.93	4330.98	253.25	
2	381.58	65.07	3.49	
3	407.26	569.36	28.57	
4	434.77	95.61	4.44	
5	460.91	138.75	6.01	
6	487.6	140.07	5.69	
7	514.09	116.03	4.41	
8	541.8	171.06	6.12	
9	570.46	128.49	4.32	
10	598.3	124.28	3.94	


SPECIMEN J9(250C)
SLOPE 99
INTERCEPT 209
J1C 246
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J9(ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J9
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                    TEST SPECIMEN DATA

 SPECIMEN NUMBER                                        J09
 MATERIAL TYPE                                          A106B
 MATERIAL CONDITION                                     WELD(PN232)
 TEST TEMPERATURE(DEG C)                                250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)              249.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)            423.4
 CRACK PLANE ORIENTATION (PER ASTM E399)                L-C
 SPECIMEN THICKNESS B(CM)                               3.047
 PERCENT SIDE GROOVE                                    21.135
 SPECIMEN WIDTH W(CM)                                   6.359
 YOUNGS MODULUS AT TEST TEMP(Pa)                        1.82776E+11
 EFFECTIVE MODULUS(Pa)                                  1.98453812E+11

                    FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                  12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM               19.43
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                    3.618

                    CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                         3.7146
 INITIAL A/W                                            .569
 AVERAGE CRACK EXTENSION 9PT(CM)                        .57
 DELTA A(CM) COMPLIANCE                                 .538
 MAX DEVIATION OF SINGLE MEASUREMENT %                  1.368

                    ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                        18
 LAST POINT                         24
 JIC(KN/M)                          246
 CORRELATION COEFF                  .95
 SLOPE M(MPa)                       99
 INTERCEPT B (KN/M)                 209

                    VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD           YES
 LIGAMENT>25JIC/EFFECTIVE YIELD     YES
 DJ/DA<EFFECTIVE YIELD              YES

                    QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                               NO
 CRACK SIZE DA<0.15*DELTA A                             YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                        404.12
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                      370.45
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                       2.741
 25*JQ/EF.Y.(CM)                                        1.828

                    CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED           18
 LAST DATA POINT USED          34
 CONSTANT(C1)                  309.7
 EXPONENT(C2)                  .4183
```

J9(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.77	1.24	.05	1.29	1.29	1.35	3.632	1
24.36	2.95	-.1	2.86	2.86	3.01	3.635	2
32.88	5.38	.08	5.46	5.46	5.75	3.645	3
40.5	8.17	1.31	9.47	9.47	9.94	3.621	4
48.39	11.66	2.74	14.4	14.4	15.07	3.623	5
55.05	15.09	6.74	21.83	21.8	22.71	3.606	6
60.86	18.44	13.75	32.19	32.21	33.24	3.618	7
64.16	20.5	26.47	46.96	46.95	48.15	3.613	8
66.86	22.26	43.16	65.42	65.51	66.67	3.622	9
69	23.7	61.17	84.87	84.94	86.21	3.62	10
71.39	25.37	79.3	104.67	105.06	106.07	3.631	11
73.21	26.68	99.83	126.52	127.17	127.96	3.638	12
74.79	27.85	120.69	148.54	149.24	150.04	3.639	13
76.02	28.78	143.78	172.55	173.43	174.1	3.642	14
78.21	30.46	164.36	194.81	196.7	196.4	3.657	15
80.27	32.08	185.45	217.53	221.84	219.08	3.687	16
79.78	31.69	215.17	246.87	248.89	248.53	3.662	17
81.21	32.83	238.75	271.58	275.81	273.21	3.683	18
83.43	34.66	258.64	293.3	301.84	294.89	3.719	19
83.48	34.7	287.08	321.78	330.46	323.38	3.72	20
84.52	35.57	311.65	347.21	358.87	348.76	3.741	21
86.52	37.27	331.77	369.04	387.45	370.5	3.784	22
87.81	38.39	355.55	393.95	417.23	395.34	3.813	23
87.54	38.15	385.41	423.56	449.21	424.86	3.826	24
87.83	38.41	410.38	448.79	479.08	449.98	3.85	25
90.35	40.64	424.97	465.6	510.15	466.73	3.917	26
90.07	40.39	454.64	495.03	541.54	496.08	3.925	27
91.41	41.6	472.4	514	573.49	514.92	3.979	28
91.62	41.79	497.59	539.39	605.48	540.17	4.005	29
91.43	41.62	523.88	565.5	638.1	566.12	4.029	30
91.76	41.92	543.55	585.47	669.97	585.93	4.071	31
91.58	41.75	566.53	608.29	702.98	608.55	4.104	32
91.93	42.07	586.57	628.64	733.84	628.77	4.137	33
91.66	41.83	612.46	654.29	765.86	654.28	4.156	34

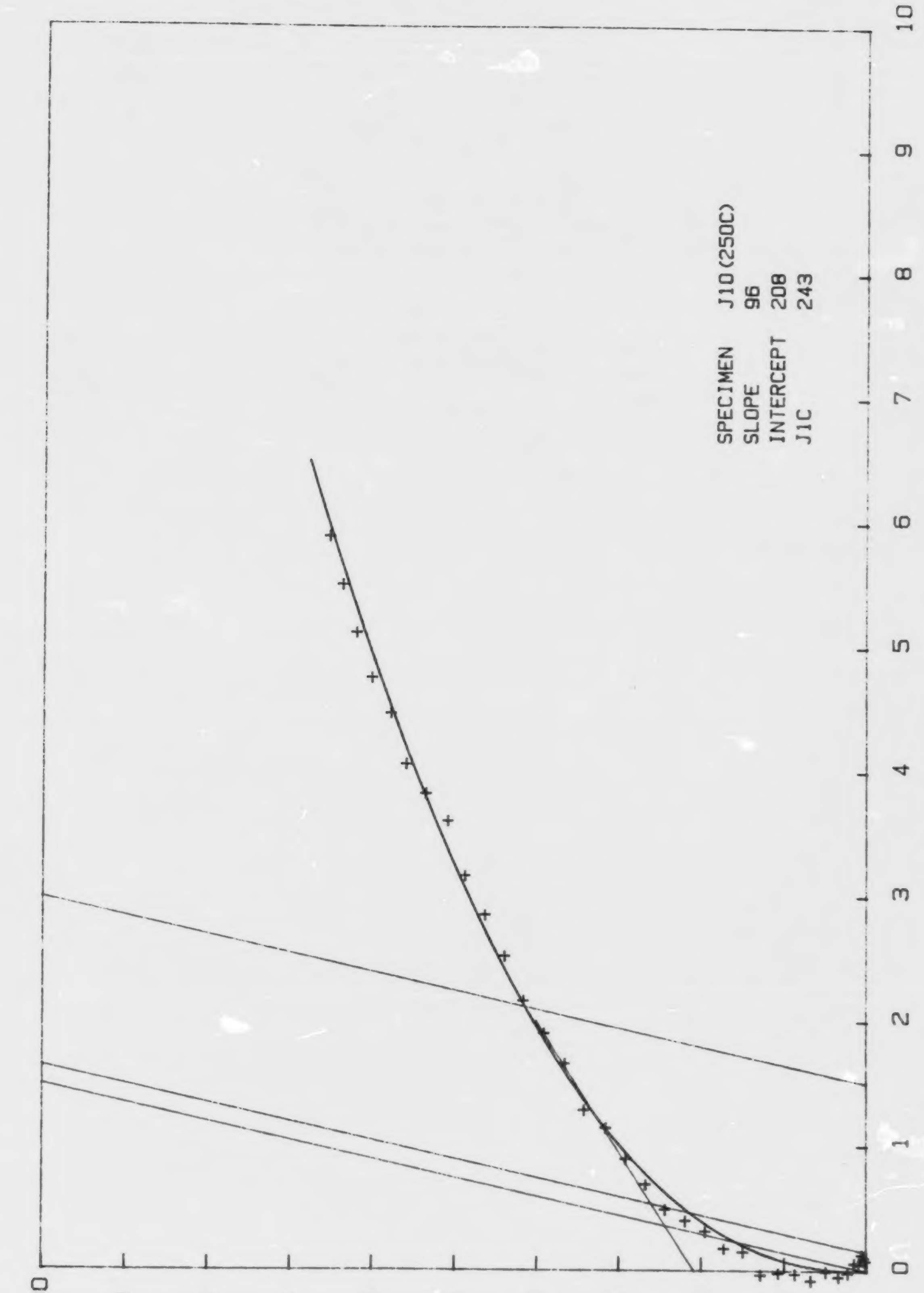
H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

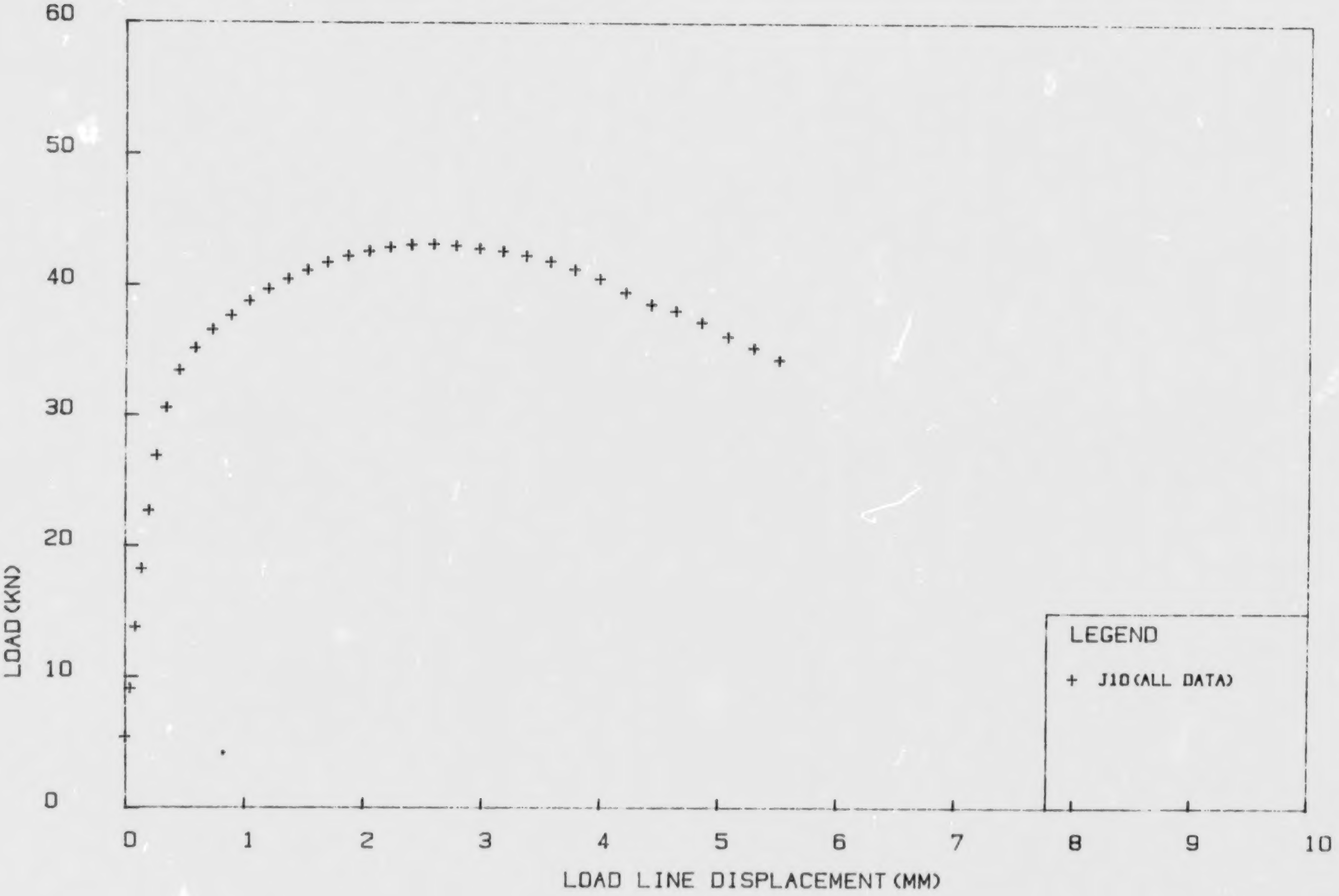
J09

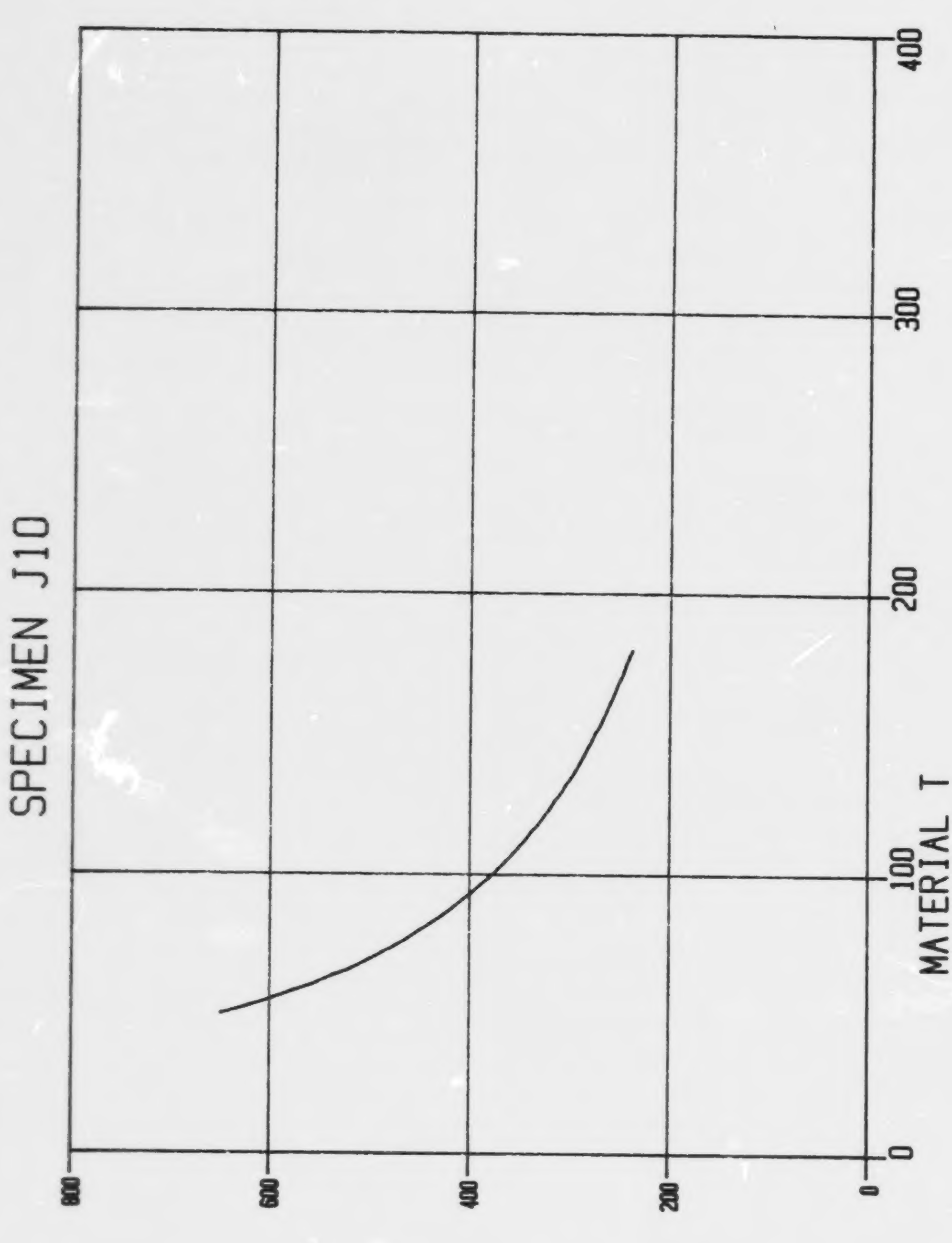
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.29	3.632	3.632	.14	.9986	1
2.86	3.634	3.635	.169	.9999	2
5.46	3.644	3.645	.265	.9998	3
9.47	3.62	3.621	.03	.9997	4
14.4	3.622	3.623	.052	.9998	5
21.83	3.604	3.606	-.121	.9999	6
32.19	3.616	3.618	2E-03	.9998	7
46.96	3.61	3.613	-.048	.9995	8
65.42	3.617	3.622	.035	.9996	9
84.87	3.615	3.62	.025	.9996	10
104.67	3.625	3.631	.131	.9998	11
126.52	3.631	3.638	.2	.9999	12
148.54	3.631	3.639	.211	.9993	13
172.55	3.633	3.642	.241	.9996	14
194.81	3.646	3.657	.385	.9998	15
217.53	3.675	3.687	.686	.9998	16
246.87	3.649	3.662	.437	.9999	17
271.58	3.669	3.683	.645	.9995	18
293.3	3.705	3.719	1.012	.9997	19
321.78	3.704	3.72	1.022	.9997	20
347.21	3.724	3.741	1.23	.9994	21
369.04	3.767	3.784	1.663	.9996	22
393.95	3.794	3.813	1.952	.9998	23
423.56	3.806	3.826	2.081	.9997	24
448.79	3.829	3.85	2.316	.999	25
465.6	3.895	3.917	2.986	1	26
495.03	3.903	3.925	3.073	.9999	27
514	3.956	3.979	3.612	.9998	28
539.39	3.981	4.005	3.871	.9998	29
565.5	4.004	4.029	4.111	.9999	30
585.47	4.045	4.071	4.525	.9998	31
608.29	4.078	4.104	4.862	.9997	32
628.64	4.11	4.137	5.192	.9998	33
654.29	4.128	4.156	5.382	.9999	34

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J09
1	5.005	0	
2	8.789	.042	
3	13.55	.085	
4	18.188	.137	
5	22.705	.195	
6	27.1	.256	
7	31.128	.332	
8	34.18	.43	
9	36.133	.554	
10	37.476	.706	
11	38.696	.857	
12	39.795	1.011	
13	40.649	1.174	
14	41.504	1.333	
15	42.114	1.504	
16	42.969	1.667	
17	43.335	1.843	
18	43.701	2.019	
19	43.945	2.202	
20	44.189	2.38	
21	44.189	2.566	
22	44.189	2.754	
23	44.067	2.947	
24	43.945	3.142	
25	43.457	3.347	
26	42.969	3.542	
27	42.358	3.757	
28	41.992	3.958	
29	41.138	4.175	
30	40.527	4.385	
31	39.795	4.6	
32	38.818	4.817	
33	37.842	5.042	
34	37.109	5.254	
35	36.499	5.471	

	J(KN/M)	T	W	J09
1	232.2	-190.25	-13.68	
2	259.22	191.58	12.24	
3	282.44	95.76	5.54	
4	307.54	4390.56	233.18	
5	334.5	197.44	9.56	
6	358.13	81.46	3.63	
7	381.49	139.49	5.76	
8	408.76	368.47	14.13	
9	436.18	173.74	6.19	
10	457.2	40.54	1.34	
11	480.32	544.17	17.07	
12	504.52	56.91	1.66	
13	526.69	158.32	4.38	
14	552.44	175.55	4.58	
15	575.49	77.95	1.92	
16	596.88	109.33	2.56	
17	618.46	99.84	2.22	
18	641.46	217.54	4.62	


SPECIMEN J10(250C)
SLOPE 96
INTERCEPT 208
J1C 243
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J10 (ALL DATA)


SPECIMEN J10
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

  SPECIMEN NUMBER                                      J10
  MATERIAL TYPE                                        A106B
  MATERIAL CONDITION                                   WELD(PN232)
  TEST TEMPERATURE(DEG C)                              250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            249.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          423.4
  CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
  SPECIMEN THICKNESS B(CM)                             3.046
  PERCENT SIDE GROOVE                                  20.879
  SPECIMEN WIDTH W(CM)                                 6.361
  YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
  EFFECTIVE MODULUS(Pa)                                1.98226705E+11

                 FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             19.93
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.664

                 CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                       3.753
  INITIAL A/W                                          .576
  AVERAGE CRACK EXTENSION 9PT(CM)                      .637
  DELTA A(CM) COMPLIANCE                               .589
  MAX DEVIATION OF SINGLE MEASUREMENT %                1.2

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                     19
  LAST POINT                      24
  JIC(KN/M)                       243
  CORRELATION COEFF               .99
  SLOPE M(MPa)                    96
  INTERCEPT B (KN/M)              208

                 VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD        YES
  LIGAMENT>25JIC/EFFECTIVE YIELD  YES
  DJ/DA<EFFECTIVE YIELD           YES

                 QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                             NO
  CRACK SIZE DA<0.15*DELTA A                           YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      405.3
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    354.54
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.697
  25*JQ/EF.Y.(CM)                                      1.806

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       19
  LAST DATA POINT USED      35
  CONSTANT(C1)              298.68
  EXPONENT(C2)              .4382
```

J10(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
16.67	1.38	.05	1.43	1.43	1.5	3.673	1
25.33	3.19	-.05	3.14	3.14	3.32	3.675	2
33.55	5.61	.2	5.81	5.81	6.13	3.678	3
41.55	8.6	1.36	9.96	9.96	10.46	3.67	4
49.29	12.1	3.04	15.14	15.14	15.84	3.671	5
55.74	15.47	7.48	22.95	22.94	23.87	3.663	6
60.87	18.45	15.85	34.3	34.28	35.4	3.66	7
64.13	20.48	29.34	49.81	49.82	51.02	3.664	8
66.42	21.96	45.93	67.9	67.8	69.21	3.657	9
68.62	23.44	63.62	87.06	87.08	88.44	3.662	10
70.65	24.85	82.16	107.01	107.06	108.48	3.663	11
72.26	25.99	102.63	128.62	128.61	130.16	3.661	12
74.49	27.63	121.98	149.61	150.52	151.16	3.68	13
75.84	28.63	143.64	172.28	173.34	173.88	3.682	14
77.58	29.97	164.96	194.93	196.96	196.55	3.696	15
78.88	30.98	188.14	219.12	221.84	220.75	3.704	16
79.99	31.86	211.98	243.83	247.4	245.48	3.713	17
81.53	33.1	234.51	267.61	273.3	269.23	3.734	18
82.87	34.19	257.64	291.83	299.89	293.43	3.754	19
84.24	35.33	280.71	316.05	327.33	317.59	3.779	20
84.73	35.74	307.05	342.79	356.08	344.28	3.793	21
86.21	37.01	329.04	366.04	385.19	367.43	3.83	22
87.15	37.81	353.92	391.73	414.98	393.04	3.854	23
87.83	38.41	378.33	416.74	444.77	417.95	3.88	24
88.94	39.39	400.49	439.88	474.94	440.97	3.916	25
89.55	39.93	423.59	463.51	505.6	464.47	3.949	26
89.79	40.14	448.02	488.16	537.33	488.96	3.981	27
90.11	40.42	468.72	509.15	568.97	509.76	4.025	28
89.33	39.73	496.11	535.84	601.24	536.25	4.046	29
89.65	40.01	519.67	559.68	631.6	559.99	4.07	30
90.16	40.48	538.29	578.77	662.47	578.93	4.111	31
89.3	39.7	562.19	601.89	694.28	601.83	4.14	32
89.48	39.86	581.08	620.94	724.89	620.73	4.176	33
89.65	40.01	597.5	637.51	754.35	637.16	4.214	34
90.31	40.61	613.2	653.81	784.2	653.37	4.253	35

H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

J10

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.43	3.672	3.673	.086	.9992	1
3.14	3.675	3.675	.111	1	2
5.81	3.677	3.678	.136	1	3
9.96	3.668	3.67	.056	.9999	4
15.14	3.669	3.671	.068	.9998	5
22.95	3.661	3.663	-.013	.9999	6
34.3	3.657	3.66	-.041	.9997	7
49.81	3.66	3.664	0	.9998	8
67.9	3.652	3.657	-.072	.9998	9
87.06	3.657	3.662	-.02	.9999	10
107.01	3.656	3.663	-.013	.9998	11
128.62	3.654	3.661	-.028	.9999	12
149.61	3.671	3.68	.157	1	13
172.28	3.673	3.682	.181	1	14
194.93	3.685	3.696	.318	.9999	15
219.12	3.693	3.704	.403	.9998	16
243.83	3.701	3.713	.494	.9997	17
267.61	3.72	3.734	.695	.9998	18
291.83	3.739	3.754	.897	1	19
316.05	3.763	3.779	1.146	.9999	20
342.79	3.776	3.793	1.287	1	21
366.04	3.813	3.83	1.662	.9997	22
391.73	3.836	3.854	1.904	1	23
416.74	3.861	3.88	2.164	.9999	24
439.88	3.896	3.916	2.521	.9999	25
463.51	3.928	3.949	2.852	.9998	26
488.16	3.958	3.981	3.165	.9999	27
509.15	4.002	4.025	3.606	.9999	28
535.84	4.022	4.046	3.823	.9995	29
559.68	4.045	4.07	4.061	.9999	30
578.77	4.085	4.111	4.469	.9999	31
601.89	4.113	4.14	4.756	.9998	32
620.94	4.149	4.176	5.116	.9999	33
637.51	4.186	4.214	5.501	1	34
653.81	4.225	4.253	5.888	.9998	35

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J10
1	5.371	0	
2	9.094	.042	
3	13.794	.088	
4	18.25	.139	
5	22.705	.2	
6	26.917	.264	
7	30.579	.344	
8	33.447	.449	
9	35.156	.583	
10	36.56	.73	
11	37.659	.884	
12	38.757	1.038	
13	39.673	1.199	
14	40.466	1.362	
15	41.138	1.526	
16	41.748	1.694	
17	42.236	1.868	
18	42.603	2.043	
19	42.908	2.222	
20	43.091	2.402	
21	43.152	2.588	
22	43.03	2.778	
23	42.786	2.976	
24	42.603	3.174	
25	42.236	3.372	
26	41.809	3.574	
27	41.199	3.779	
28	40.466	3.992	
29	39.429	4.209	
30	38.513	4.426	
31	38.025	4.634	
32	37.17	4.851	
33	36.072	5.073	
34	35.217	5.293	
35	34.302	5.508	
36	33.569	5.728	

```
        J(KN/M)               T            W      J10

1         231.47       441.44            31.25
2         255.72       190.58            12.12
3         279.72       194.26            11.21
4         303.94       157.11            8.26
5         329.42       306.98            14.81
6         354.42       100.05            4.42
7         378.89       171.72            7.03
8         404.24       155.11            5.89
9         428.31       104.93            3.71
10        451.69       115.14            3.81
11        475.84       127.25            3.94
12        498.65       76.92             2.23
13        522.49       198.22            5.44
14        547.76       161.96            4.19
15        569.23       75.57             1.85
16        590.33       130.53            3.04
17        611.42       85.28             1.89
18        629.23       69.59             1.47
19        645.66       67.98             1.37
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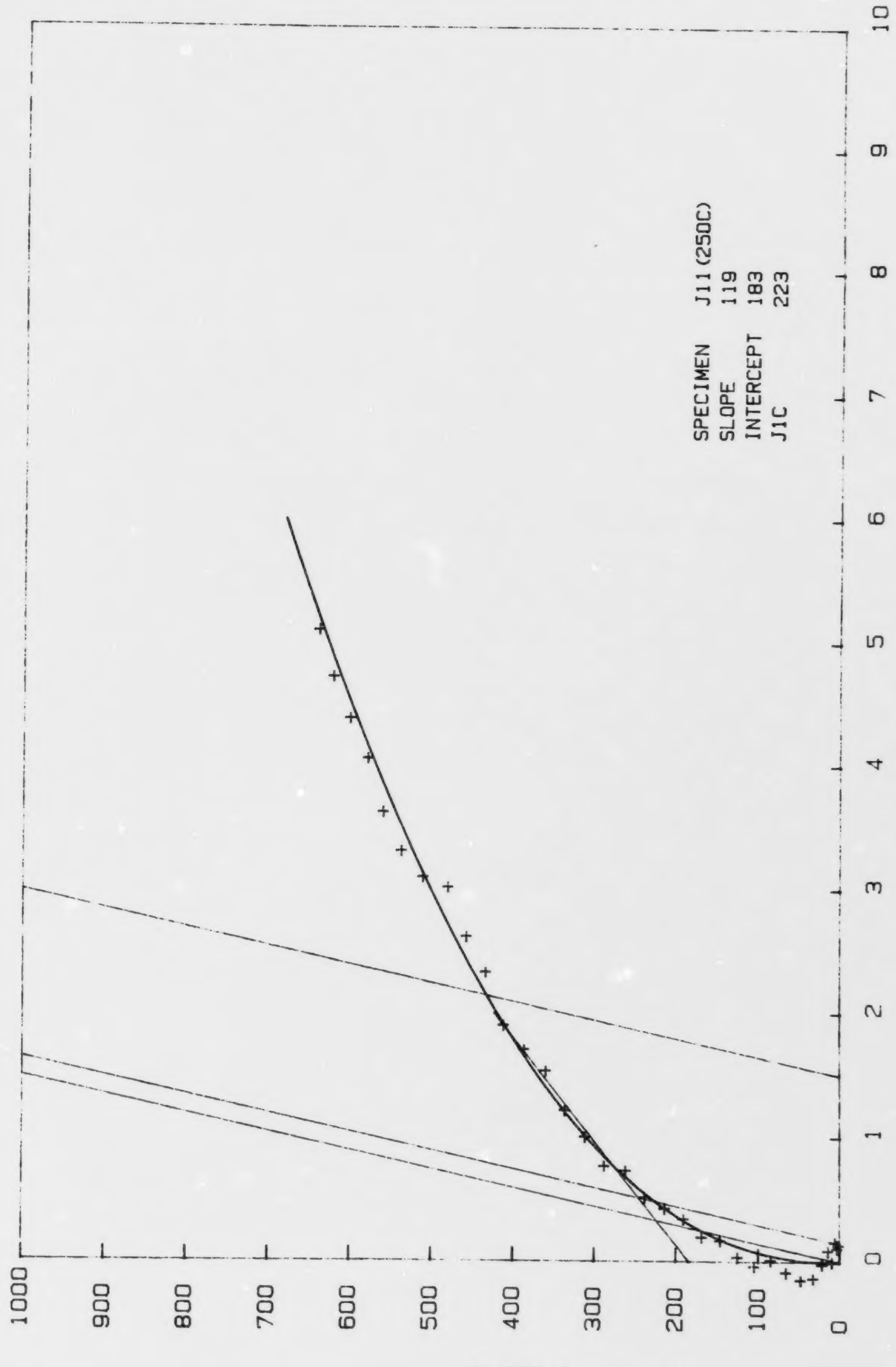
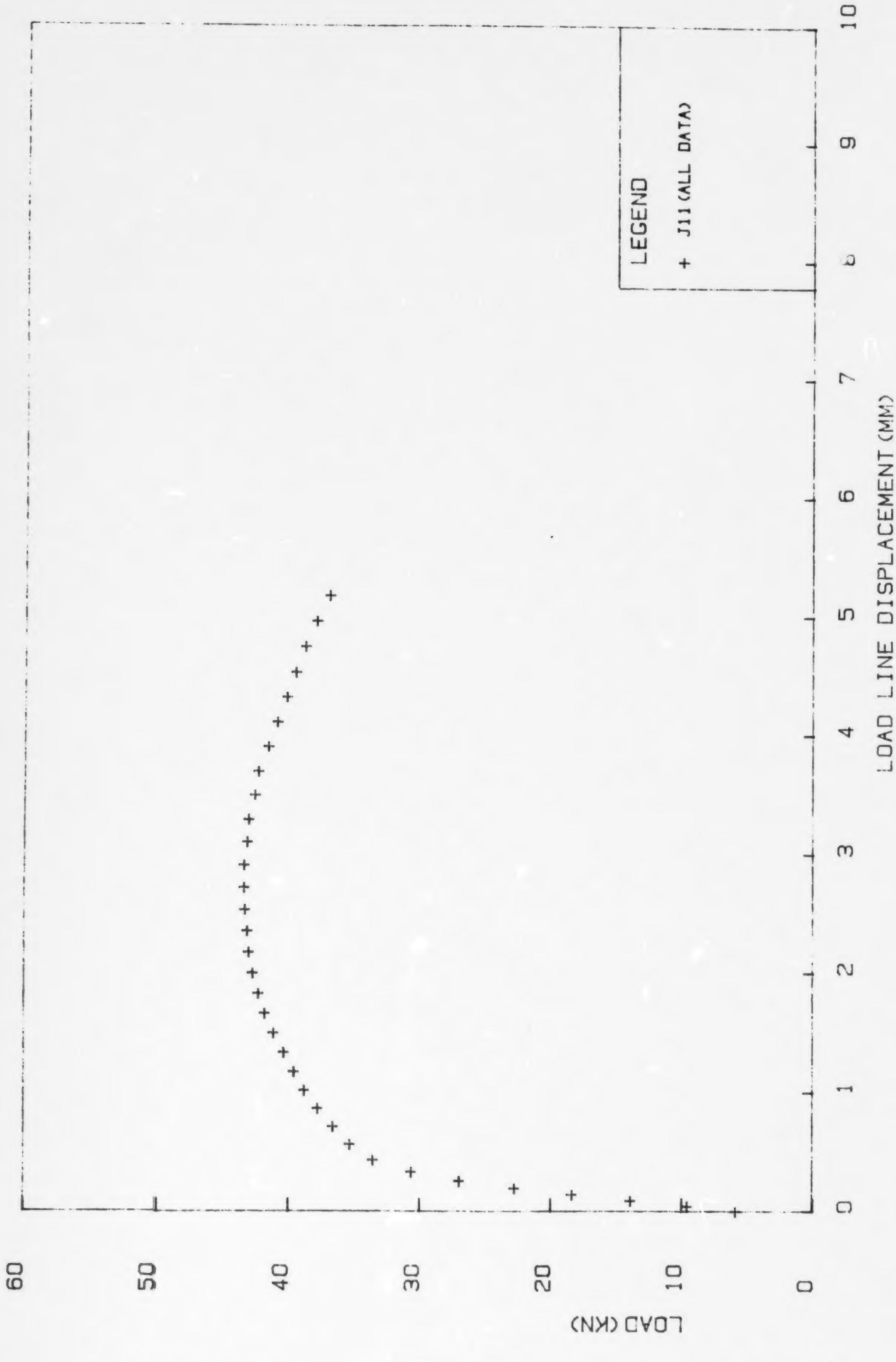
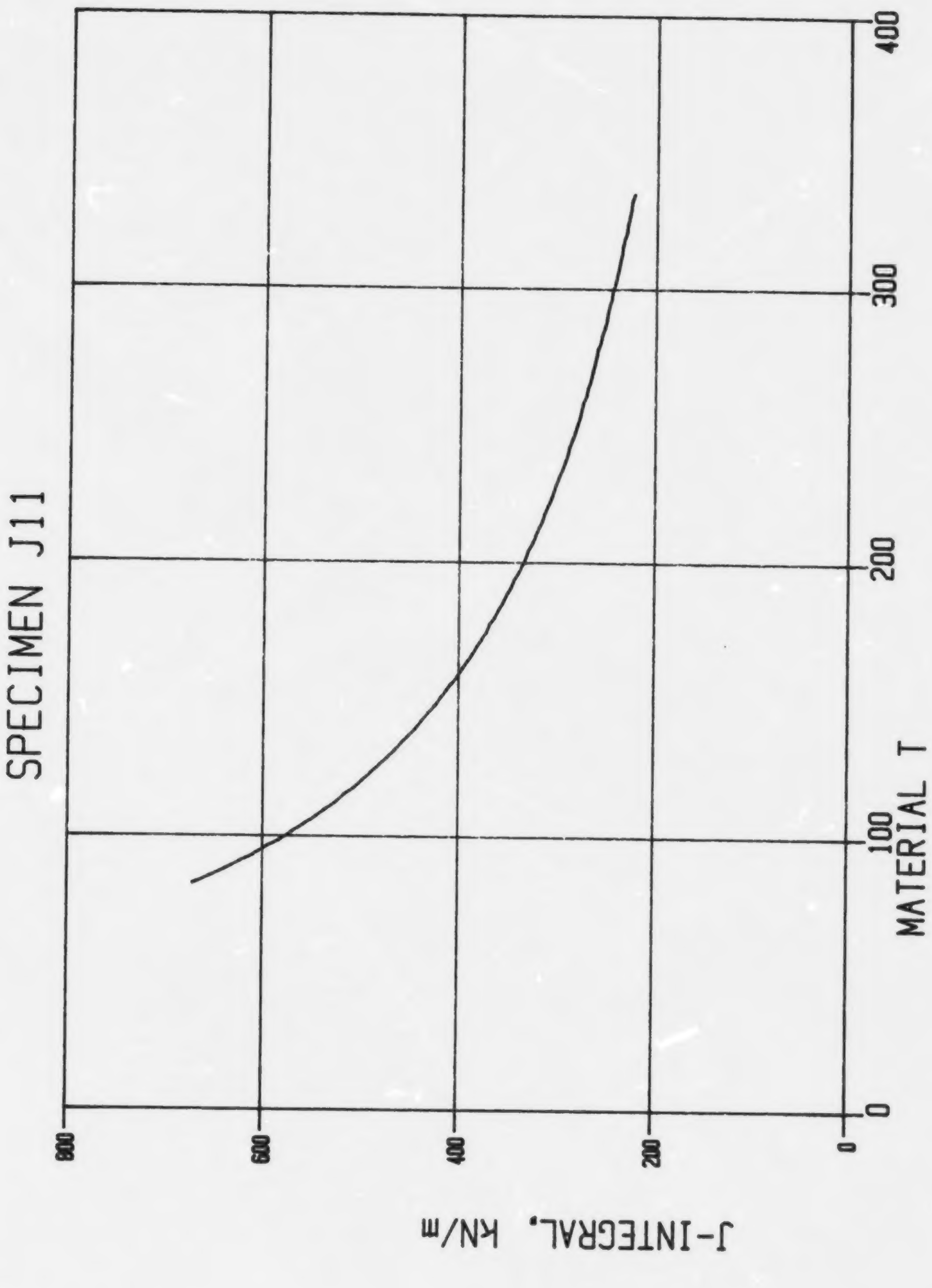

SPECIMEN J11 (250C)
SLOPE 119
INTERCEPT 183
J1C 223
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J11 (ALL DATA)


SPECIMEN J11
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

  SPECIMEN NUMBER                                    J11
  MATERIAL TYPE                                      A106B
  MATERIAL CONDITION                                 WELD(PN232)
  TEST TEMPERATURE(DEG C)                            250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          249.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        423.4
  CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
  SPECIMEN THICKNESS B(CM)                           3.051
  PERCENT SIDE GROOVE                                21.402
  SPECIMEN WIDTH W(CM)                               6.36
  YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
  EFFECTIVE MODULUS(Pa)                              1.99576444E+11

                  FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           19.67
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.643

                  CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                     3.745
  INITIAL A/W                                        .573
  AVERAGE CRACK EXTENSION 9PT(CM)                    .545
  DELTA A(CM) COMPLIANCE                             .509
  MAX DEVIATION OF SINGLE MEASUREMENT %              .83

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                      17
  LAST POINT                       24
  JIC(KN/M)                        223
  CORRELATION COEFF                .98
  SLOPE M(MPa)                     119
  INTERCEPT B (KN/M)               183

                  VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD        YES
  LIGAMENT>25JIC/EFFECTIVE YIELD  YES
  DJ/DA<EFFECTIVE YIELD           YES

                  QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                           NO
  CRACK SIZE DA<0.15*DELTA A                         YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    403.28
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  371.28
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.717
  25*JQ/EF.Y.(CM)                                    1.657

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       17
  LAST DATA POINT USED      34
  CONSTANT(C1)              309.72
  EXPONENT(C2)              .4398
```

J11(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
17.44	1.51	.06	1.57	1.57	1.65	3.657	1
25.29	3.18	.16	3.34	3.34	3.52	3.654	2
33.49	5.58	.43	6.02	6.02	6.34	3.659	3
41.11	8.42	1.29	9.71	9.7	10.21	3.643	4
48.97	11.94	2.67	14.61	14.62	15.32	3.652	5
55.28	15.21	6.77	21.98	21.97	22.9	3.641	6
60.17	18.03	14.92	32.94	32.89	34.04	3.63	7
63.3	19.95	28.34	48.29	48.23	49.51	3.628	8
65.83	21.57	44.63	66.2	66.23	67.49	3.635	9
68.29	23.22	61.67	84.89	85.13	86.24	3.644	10
69.96	24.37	80.49	104.86	104.94	106.3	3.639	11
71.69	25.59	99.65	125.24	125.61	126.72	3.647	12
73.69	27.04	119.22	146.26	147.28	147.78	3.66	13
75.25	28.19	140.34	168.53	169.71	170.11	3.663	14
77.13	29.62	161.18	190.8	192.98	192.4	3.677	15
78.42	30.62	183.37	213.99	216.86	215.61	3.686	16
79.62	31.56	206.9	238.47	242.13	240.11	3.695	17
81.21	32.84	229.02	261.86	267.72	263.48	3.716	18
81.62	33.17	255.05	288.21	294.5	289.84	3.72	19
83.11	34.39	277.19	311.57	320.83	313.17	3.743	20
84.3	35.38	301.03	336.41	348.62	337.96	3.764	21
85.94	36.77	323.22	359.99	377.04	361.49	3.796	22
86.36	37.13	349.57	386.7	406.56	388.12	3.813	23
87.16	37.82	374.49	412.31	435.66	413.68	3.833	24
88.52	39.01	395.58	434.59	466.22	435.84	3.876	25
89.65	40.01	418.31	458.32	495.91	459.5	3.905	26
90.25	40.55	440.61	481.16	527.47	482.18	3.944	27
89.28	39.69	472.12	511.81	560.1	512.71	3.953	28
88.89	39.34	498.94	538.28	591.84	539.03	3.973	29
89.24	39.65	520.86	560.51	622.47	561.13	4.005	30
90.21	40.52	539.05	579.57	653.86	580.07	4.048	31
90.21	40.51	560.84	601.35	685.25	601.69	4.081	32
90	40.33	581.71	622.04	716.56	622.2	4.115	33
90.93	41.16	598.21	639.37	746.3	639.45	4.152	34

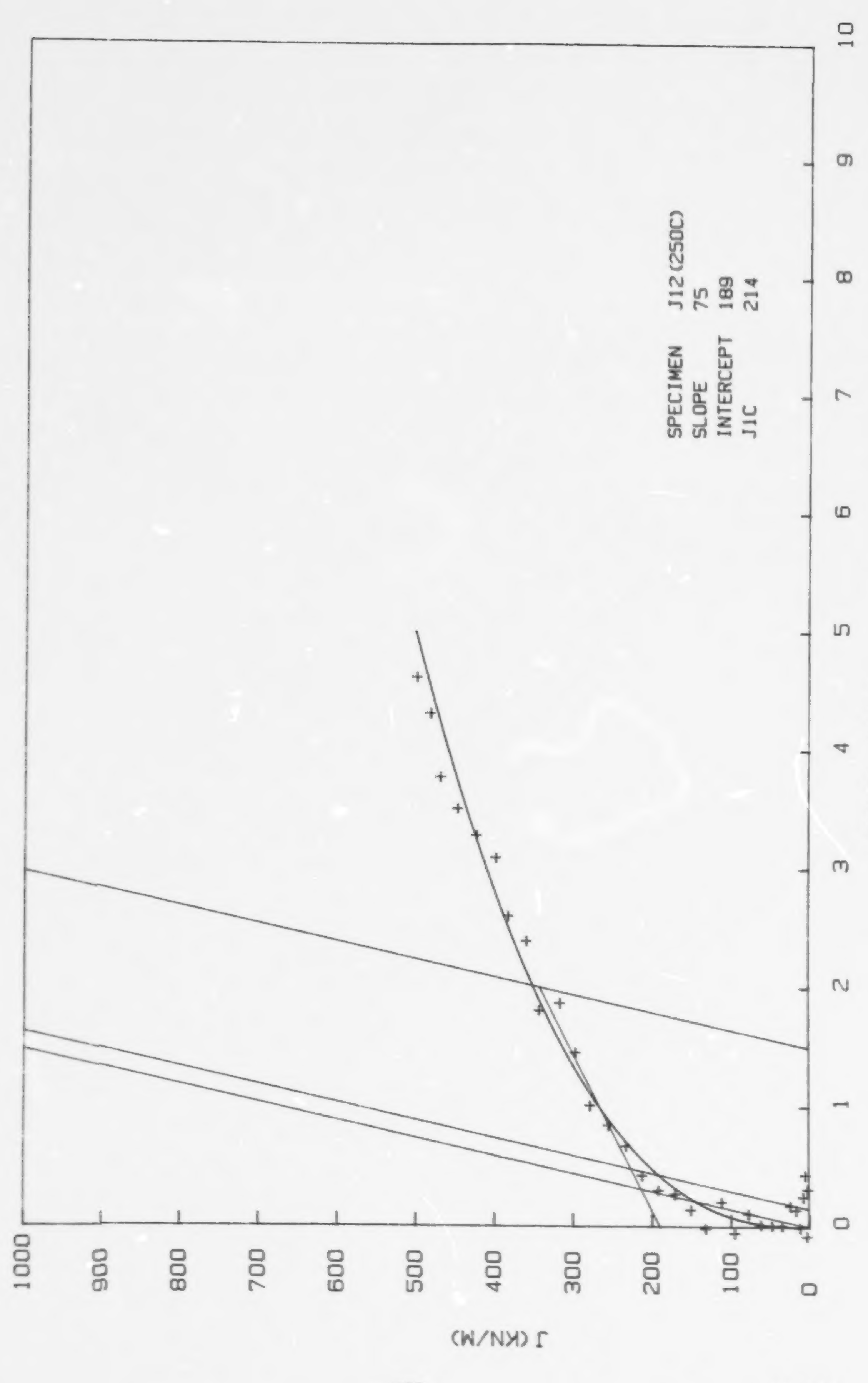
H(M)	D(M)	POISSON´S RATIO
.02383	2.54E-03	.3

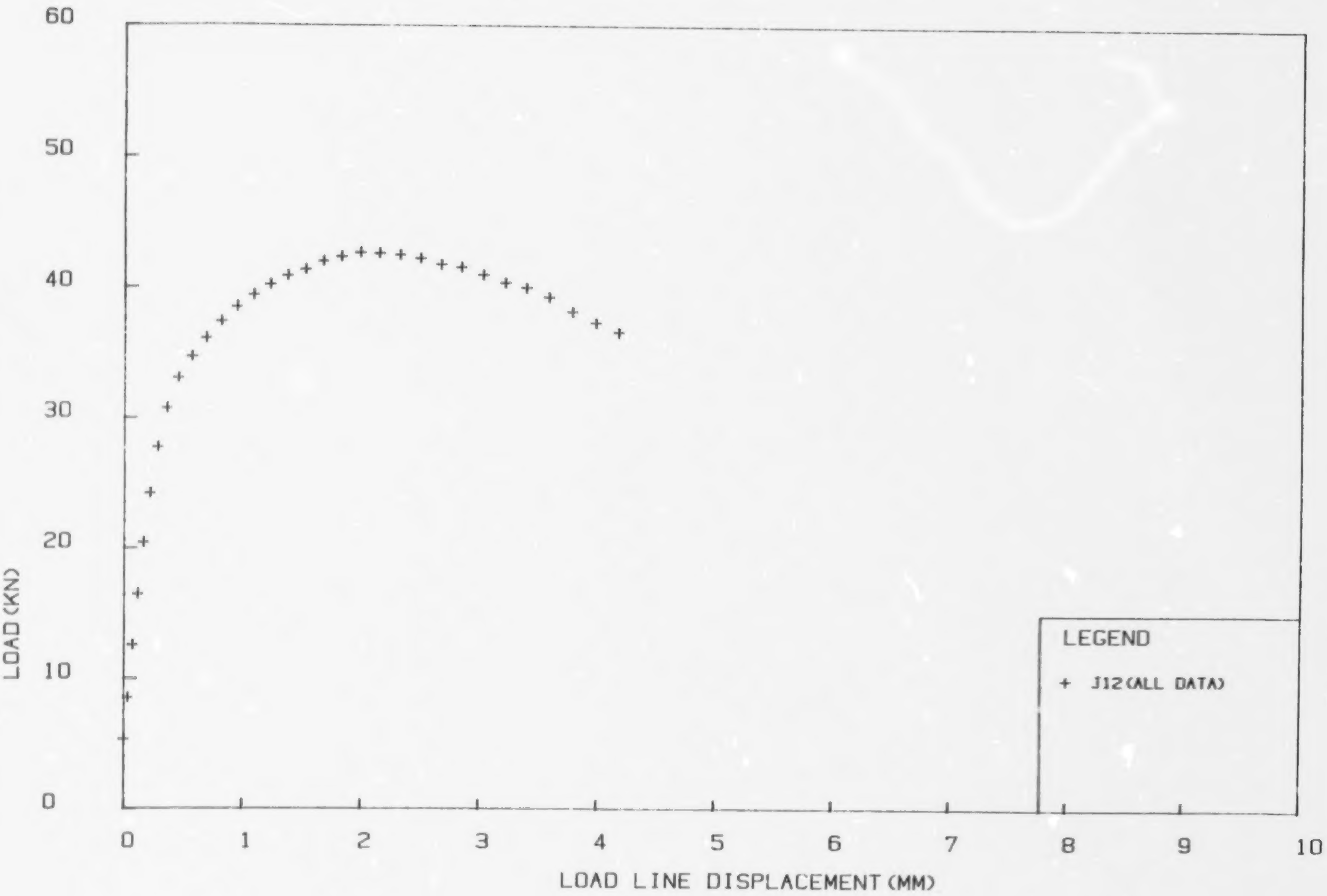
J11

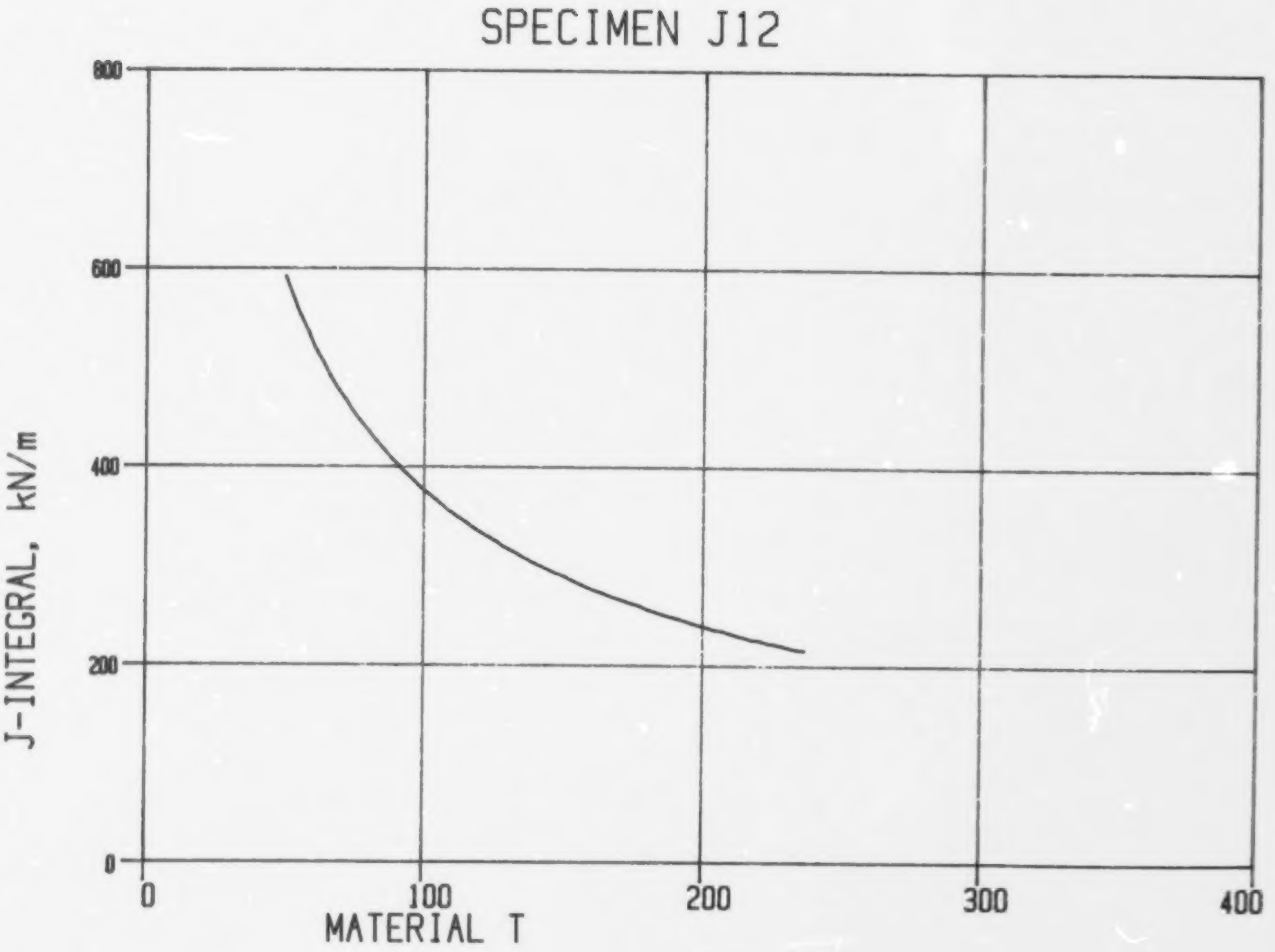
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.57	3.656	3.657	.137	.9983	1
3.34	3.653	3.654	.107	.9999	2
6.02	3.658	3.659	.16	.9995	3
9.71	3.642	3.643	-2E-03	.9996	4
14.61	3.65	3.652	.089	.9997	5
21.98	3.639	3.641	-.019	.9998	6
32.94	3.627	3.63	-.133	.9999	7
48.29	3.625	3.628	-.146	.9998	8
66.2	3.63	3.635	-.084	.9999	9
84.89	3.639	3.644	.014	1	10
104.86	3.633	3.639	-.038	.9998	11
125.24	3.639	3.647	.036	.9998	12
146.26	3.652	3.66	.169	.9999	13
168.53	3.653	3.663	.196	.9999	14
190.8	3.667	3.677	.343	.9999	15
213.99	3.675	3.686	.429	1	16
238.47	3.682	3.695	.516	.9999	17
261.86	3.703	3.716	.731	.9998	18
288.21	3.705	3.72	.768	.9998	19
311.57	3.728	3.743	1.002	1	20
336.41	3.748	3.764	1.215	.9999	21
359.99	3.779	3.796	1.533	.9999	22
386.7	3.795	3.813	1.704	.9999	23
412.31	3.813	3.833	1.899	.9998	24
434.59	3.855	3.876	2.328	.9999	25
458.32	3.883	3.905	2.617	.9999	26
481.16	3.922	3.944	3.012	.9998	27
511.81	3.929	3.953	3.097	.9999	28
538.28	3.949	3.973	3.305	.9998	29
560.51	3.98	4.005	3.618	.9998	30
579.57	4.022	4.048	4.053	.9999	31
601.35	4.054	4.081	4.376	.9999	32
622.04	4.087	4.115	4.715	.9999	33
639.37	4.124	4.152	5.093	.9999	34

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J11
1	5.859	0	
2	9.583	.042	
3	13.916	.088	
4	18.372	.139	
5	22.766	.193	
6	26.978	.254	
7	30.64	.33	
8	33.569	.43	
9	35.339	.562	
10	36.621	.71	
11	37.781	.862	
12	38.818	1.013	
13	39.612	1.169	
14	40.405	1.331	
15	41.199	1.492	
16	41.87	1.658	
17	42.358	1.824	
18	42.786	1.997	
19	43.091	2.173	
20	43.213	2.351	
21	43.396	2.529	
22	43.457	2.715	
23	43.457	2.905	
24	43.213	3.098	
25	43.091	3.289	
26	42.603	3.494	
27	42.358	3.689	
28	41.565	3.899	
29	40.894	4.109	
30	40.161	4.319	
31	39.49	4.526	
32	38.757	4.744	
33	37.903	4.958	
34	36.926	5.176	
35	36.316	5.386	

	J(KN/M)	T	W	J11
1	226.23	450.31	32.84	
2	250.16	175.75	11.5	
3	275.03	1151.48	68.42	
4	299.89	161.61	8.73	
5	323.99	188.35	9.34	
6	348.2	119.85	5.46	
7	373.35	251.89	10.63	
8	399.5	212.43	8.32	
9	423.45	83.95	3.05	
10	446.46	132.73	4.52	
11	469.74	93.23	2.97	
12	496.48	585.68	17.58	
13	525.05	205.53	5.78	
14	549.4	114.81	3.05	
15	570.04	70.73	1.78	
16	590.46	109.08	2.61	
17	611.69	98.47	2.24	
18	630.7	74.14	1.61	


J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
SPECIMEN J12(250C)
SLOPE 75
INTERCEPT 189
J1C 214


LOAD (KN)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J12 (ALL DATA)


SPECIMEN J12
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                     J12
  MATERIAL TYPE                                       A106B
  MATERIAL CONDITION                                  WELD(PN232)
  TEST TEMPERATURE(DEG C)                             250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           249.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         423.4
  CRACK PLANE ORIENTATION (PER ASTM E399)             L-C
  SPECIMEN THICKNESS B(CM)                            3.04
  PERCENT SIDE GROOVE                                 20.46
  SPECIMEN WIDTH W(CM)                                6.351
  YOUNGS MODULUS AT TEST TEMP(Pa)                     1.82776E+11
  EFFECTIVE MODULUS(Pa)                               1.97197282E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN               12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            19.67
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                 3.63

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                      3.736
  INITIAL A/W                                         .572
  AVERAGE CRACK EXTENSION 9PT(CM)                     .529
  DELTA A(CM) COMPLIANCE                              .461
  MAX DEVIATION OF SINGLE MEASUREMENT %               .96

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                    19
  LAST POINT                     24
  JIC(KN/M)                      214
  CORRELATION COEFF              .91
  SLOPE M(MPa)                   75
  INTERCEPT B (KN/M)             189

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD       YES
  LIGAMENT>25JIC/EFFECTIVE YIELD YES
  DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                            NO
  CRACK SIZE DA<0.15*DELTA A                          NO
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     406.65
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   380.05
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.721
  25*JQ/EF.Y.(CM)                                     1.591

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       19
  LAST DATA POINT USED      32
  CONSTANT(C1)              266.41
  EXPONENT(C2)              .3938
```

J12(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.62	1.21	.01	1.23	1.23	1.26	3.661	1
22.47	2.51	.17	2.69	2.69	2.81	3.622	2
30.33	4.58	.11	4.69	4.69	4.9	3.674	3
37.23	6.9	.65	7.55	7.56	7.91	3.655	4
43.48	9.41	2.23	11.64	11.63	12.15	3.629	5
50.26	12.58	4.24	16.82	16.83	17.49	3.644	6
55.78	15.49	8.77	24.26	24.28	25.09	3.648	7
59.42	17.58	17.29	34.87	34.81	35.84	3.631	8
62.38	19.37	28.41	47.78	47.73	48.86	3.631	9
64.93	20.99	41.01	62	61.96	63.16	3.632	10
67.58	22.74	54.93	77.67	77.81	78.9	3.641	11
68.91	23.64	71.68	95.32	95.02	96.66	3.624	12
71.63	25.54	86.57	112.11	112.73	113.47	3.651	13
72.14	25.91	106.41	132.32	131.99	133.78	3.629	14
74.01	27.27	123.76	151.03	151.51	152.51	3.644	15
75.46	28.35	142.69	171.04	172.32	172.53	3.657	16
76.72	29.3	162.73	192.04	193.55	193.57	3.661	17
77.95	30.25	182.62	212.87	215.37	214.41	3.673	18
79.64	31.58	201.38	232.96	237.67	234.49	3.698	19
80.34	32.14	222.94	255.08	261.5	256.57	3.715	20
80.91	32.59	245.48	278.07	286.34	279.51	3.731	21
82.63	33.99	262.84	296.83	310.58	298.2	3.776	22
83.77	34.94	281.56	316.5	335.78	317.78	3.817	23
83.08	34.36	308.73	343.1	361.46	344.37	3.811	24
84.9	35.89	323.68	359.57	387.19	360.75	3.869	25
84.77	35.77	347.34	383.11	414.29	384.18	3.89	26
86.7	37.43	361.63	399.06	439.19	400.09	3.939	27
86.15	36.96	386.61	423.57	467.28	424.46	3.958	28
85.01	35.98	411.85	447.83	496.25	448.52	3.981	29
84.59	35.62	434.1	469.73	524.04	470.26	4.007	30
86.01	36.83	445.95	482.78	549.78	483.27	4.06	31
86.99	37.67	462.78	500.46	575.07	500.88	4.091	32

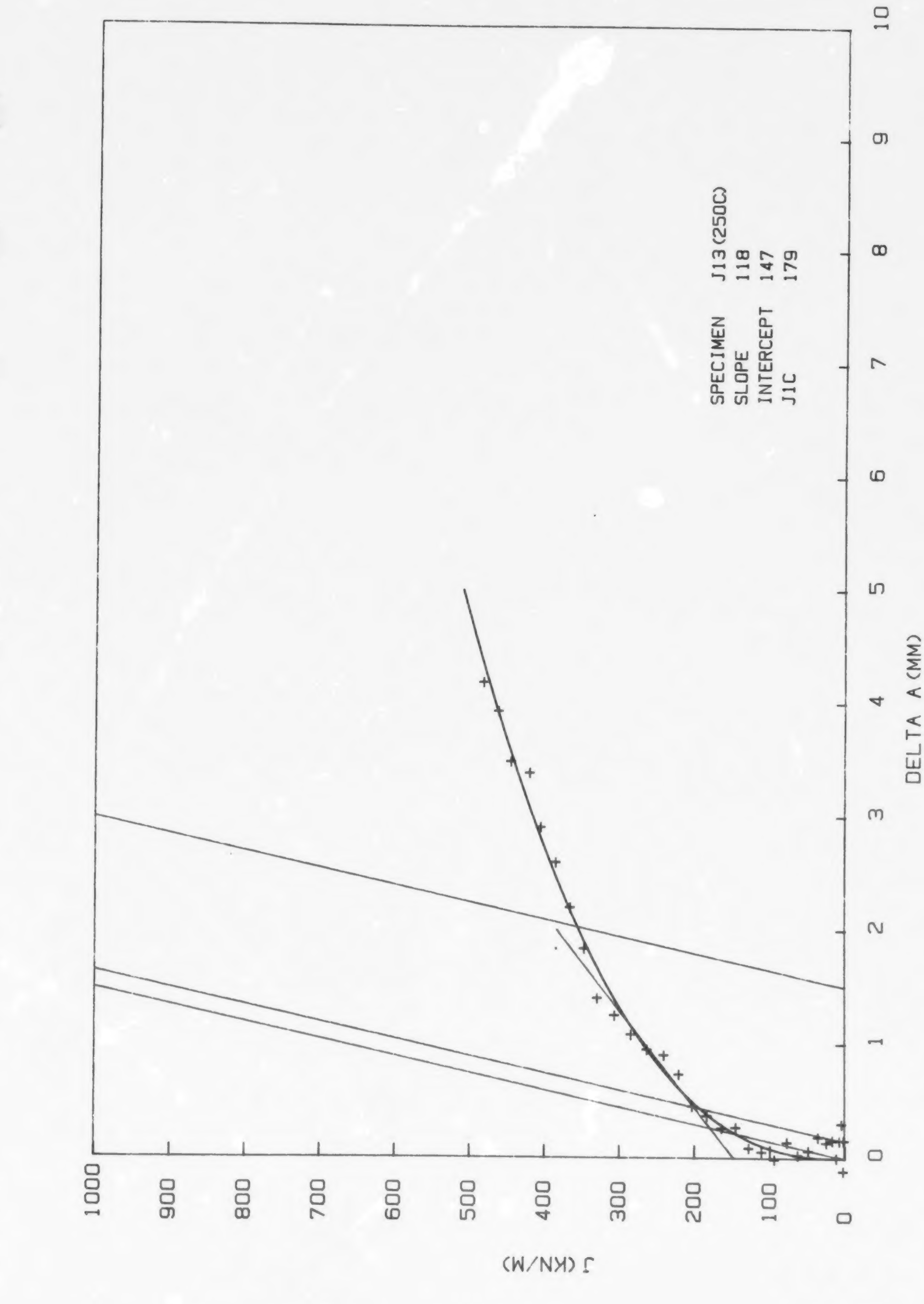
H(M)	D(M)	POISSON'S RATIO
.02384	2.54E-03	.3

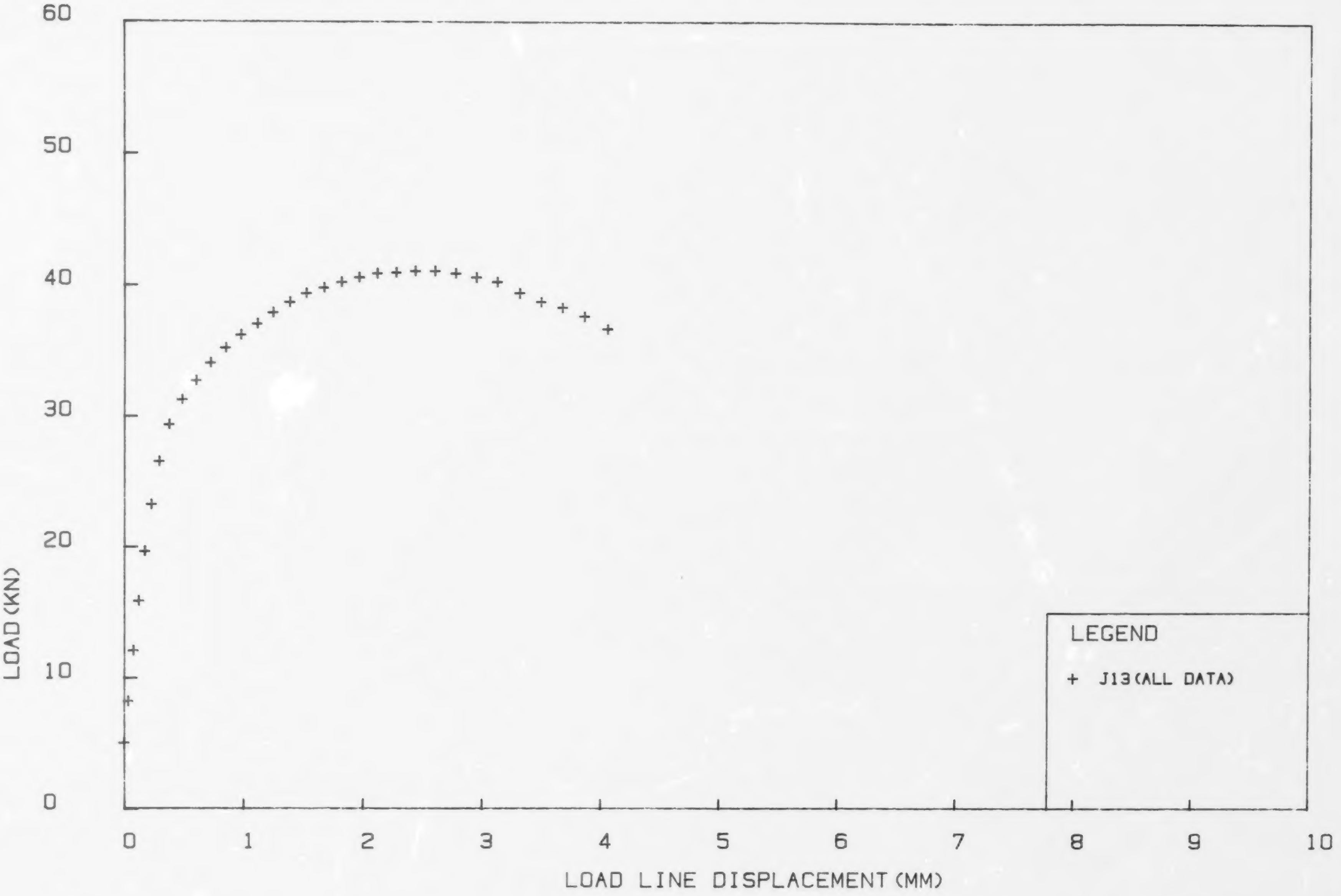
J12

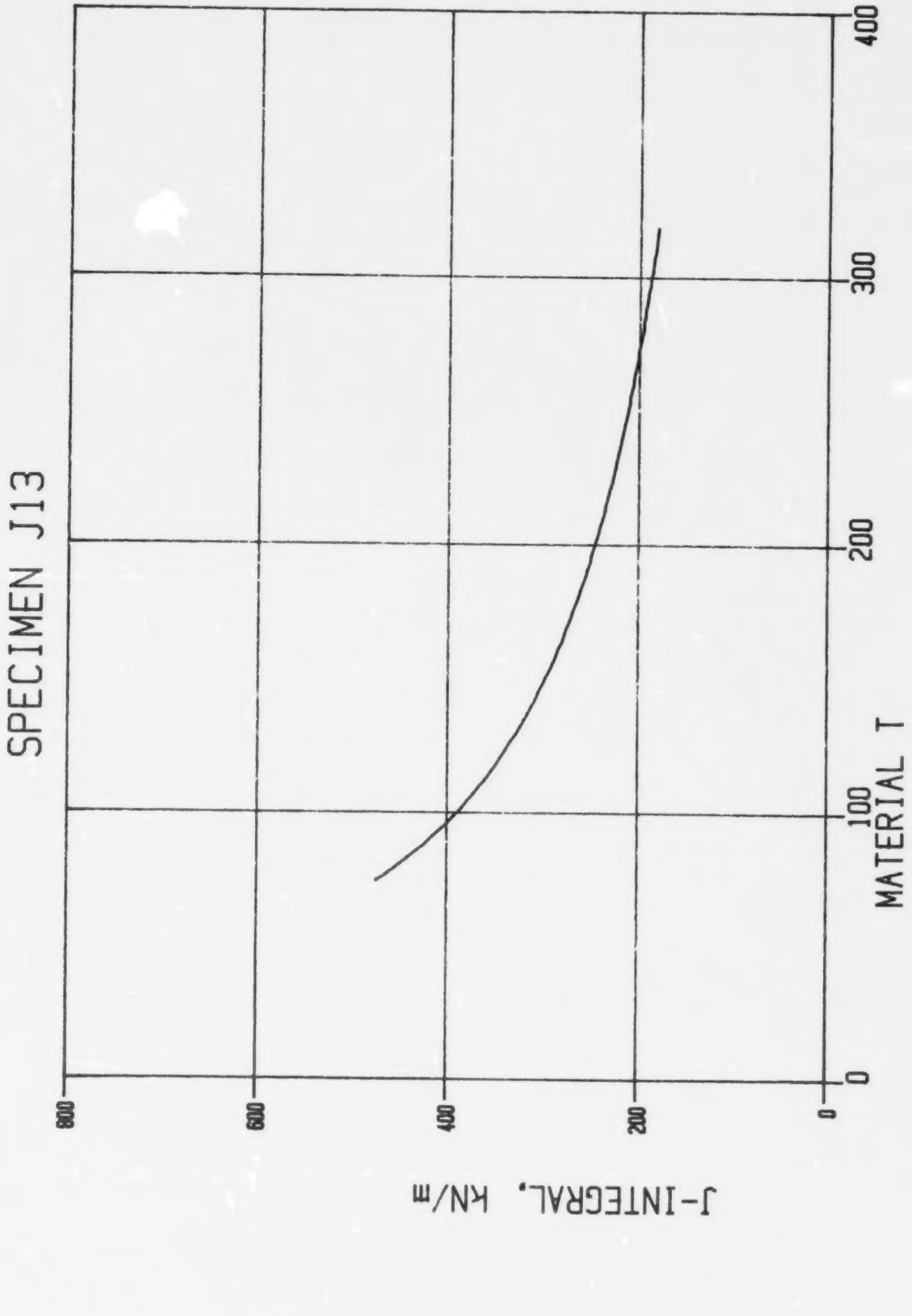
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.23	3.661	3.661	.314	.9993	1
2.69	3.621	3.622	-.081	.9994	2
4.69	3.673	3.674	.436	.9993	3
7.55	3.654	3.655	.249	.9984	4
11.64	3.628	3.629	-7E-03	.9998	5
16.82	3.642	3.644	.142	.9997	6
24.26	3.645	3.648	.176	.9996	7
34.87	3.628	3.631	.011	.9998	8
47.78	3.628	3.631	.011	.9997	9
62	3.628	3.632	.018	.9999	10
77.67	3.636	3.641	.109	.9998	11
95.32	3.618	3.624	-.056	.9999	12
112.11	3.644	3.651	.209	.9996	13
132.32	3.621	3.629	-.015	.9995	14
151.03	3.636	3.644	.142	.9997	15
171.04	3.648	3.657	.274	.9997	16
192.04	3.65	3.661	.307	.9998	17
212.87	3.662	3.673	.43	.9998	18
232.96	3.685	3.698	.675	.9999	19
255.08	3.702	3.715	.847	.9996	20
278.07	3.717	3.731	1.013	.9997	21
296.83	3.761	3.776	1.459	.9996	22
316.5	3.802	3.817	1.873	.9996	23
343.1	3.794	3.811	1.809	.9999	24
359.57	3.852	3.869	2.393	.9995	25
383.11	3.872	3.89	2.604	.9997	26
399.06	3.92	3.939	3.094	.9998	27
423.57	3.938	3.958	3.279	.9999	28
447.83	3.96	3.981	3.506	.9994	29
469.73	3.985	4.007	3.77	.9984	30
482.78	4.038	4.06	4.305	.9994	31
500.46	4.068	4.091	4.612	.9998	32

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J12
1	5.31	0	
2	8.545	.034	
3	12.573	.076	
4	16.479	.121	
5	20.447	.167	
6	24.231	.221	
7	27.771	.283	
8	30.762	.36	
9	33.081	.457	
10	34.729	.57	
11	36.133	.69	
12	37.415	.819	
13	38.513	.951	
14	39.429	1.09	
15	40.222	1.229	
16	40.894	1.375	
17	41.382	1.526	
18	41.992	1.676	
19	42.358	1.83	
20	42.664	1.987	
21	42.603	2.152	
22	42.48	2.323	
23	42.236	2.495	
24	41.748	2.672	
25	41.565	2.842	
26	40.955	3.027	
27	40.344	3.213	
28	39.978	3.391	
29	39.246	3.583	
30	38.147	3.784	
31	37.292	3.982	
32	36.56	4.175	
33	36.194	4.358	

	J(KN/M)	T	W	J12
1	222.91	132.19	9.74	
2	244.02	207.75	13.89	
3	266.57	223.88	13.62	
4	287.45	68.04	3.77	
5	306.66	76.81	3.93	
6	329.8	-678.97	-32.37	
7	351.33	45.55	1.99	
8	371.34	180.86	7.42	
9	391.08	52.54	2.01	
10	411.31	213.74	7.7	
11	435.7	173.16	5.83	
12	458.78	133.99	4.24	
13	476.26	39.44	1.17	
14	491.62	92.97	2.65	


SPECIMEN J13 (250C)
SLOPE 118
INTERCEPT 147
J1C 179
J (KN/M)
1000
900
800
700
600
500
400
300
200
100
0
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J13 (ALL DATA)


SPECIMEN J13
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

SPECIMEN NUMBER                                J13
MATERIAL TYPE                                  A106B
MATERIAL CONDITION                             HAZ(PN232)
TEST TEMPERATURE(DEG C)                        250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)      249.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)    423.4
CRACK PLANE ORIENTATION (PER ASTM E399)        L-C
SPECIMEN THICKNESS B(CM)                       3.055
PERCENT SIDE GROOVE                            20.327
SPECIMEN WIDTH W(CM)                           6.3
YOUNGS MODULUS AT TEST TEMP(Pa)                1.82776E+11
EFFECTIVE MODULUS(Pa)                          2.0022761E+11

               FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN          12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM       20.36
INITIAL CRACK LENGTH-COMPLIANCE(CM)            3.662

               CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                 3.767
INITIAL A/W                                    .581
AVERAGE CRACK EXTENSION 9PT(CM)                .444
DELTA A(CM) COMPLIANCE                         .418
MAX DEVIATION OF SINGLE MEASUREMENT %          .95

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                    18
LAST POINT                     25
JIC(KN/M)                      179
CORRELATION COEFF              .94
SLOPE M(MPa)                   118
INTERCEPT B (KN/M)             147

               VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD       YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                       NO
CRACK SIZE DA<0.15*DELTA A                     NO
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                409.34
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M              373.37
DELTA A(MAX) ALLOWED(MM)(0.1*b0)               2.638
25*JQ/EF.Y.(CM)                                1.33

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED      18
LAST DATA POINT USED     32
CONSTANT(C1)             269.19
EXPONENT(C2)             .3991
```

J13(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.44	1.19	.01	1.2	1.2	1.25	3.678	1
22.29	2.47	.18	2.66	2.66	2.8	3.651	2
30.01	4.48	.16	4.64	4.64	4.87	3.692	3
36.83	6.75	.9	7.66	7.66	8.03	3.677	4
43.19	9.29	2.39	11.68	11.68	12.22	3.662	5
49.77	12.33	4.83	17.16	17.17	17.86	3.678	6
54.96	15.04	10.05	25.09	25.1	25.95	3.676	7
58.68	17.14	19.04	36.18	36.22	37.15	3.68	8
60.99	18.52	30.75	49.27	49.19	50.35	3.668	9
63.35	19.98	43.42	63.41	63.27	64.58	3.665	10
65.95	21.65	56.3	77.96	78.06	79.2	3.676	11
67.18	22.47	71.99	94.46	94.15	95.8	3.661	12
69.03	23.72	87.62	111.34	111.26	112.73	3.668	13
70.76	24.93	103.56	128.49	128.55	129.94	3.671	14
73.02	26.55	119.04	145.58	146.58	147.07	3.689	15
74.26	27.45	136.91	164.36	165.31	165.9	3.688	16
75.54	28.41	155.31	183.72	185.41	185.28	3.699	17
76.75	29.33	174.15	203.48	205.85	205.06	3.708	18
78.78	30.9	190.51	221.4	226.24	222.98	3.735	19
80.19	32.02	209.3	241.32	247.8	242.9	3.752	20
80.56	32.31	231.51	263.82	270.82	265.39	3.757	21
81.45	33.03	252.31	285.33	293.87	286.9	3.77	22
82.3	33.73	273.58	307.3	318.04	308.83	3.787	23
82.71	34.06	296.16	330.22	343.09	331.7	3.802	24
84.4	35.46	312.52	347.99	367.58	349.39	3.846	25
85.61	36.49	330.41	366.9	392.47	368.23	3.882	26
86	36.83	349.81	386.64	419.2	387.82	3.921	27
86.3	37.08	369.86	406.94	445.35	407.99	3.952	28
88.17	38.7	383.26	421.96	470.05	422.98	4	29
87.22	37.88	409.26	447.14	497.34	448.03	4.01	30
87.61	38.21	425.67	463.88	524.14	464.63	4.054	31
88.03	38.58	445.25	483.84	550.27	484.48	4.08	32

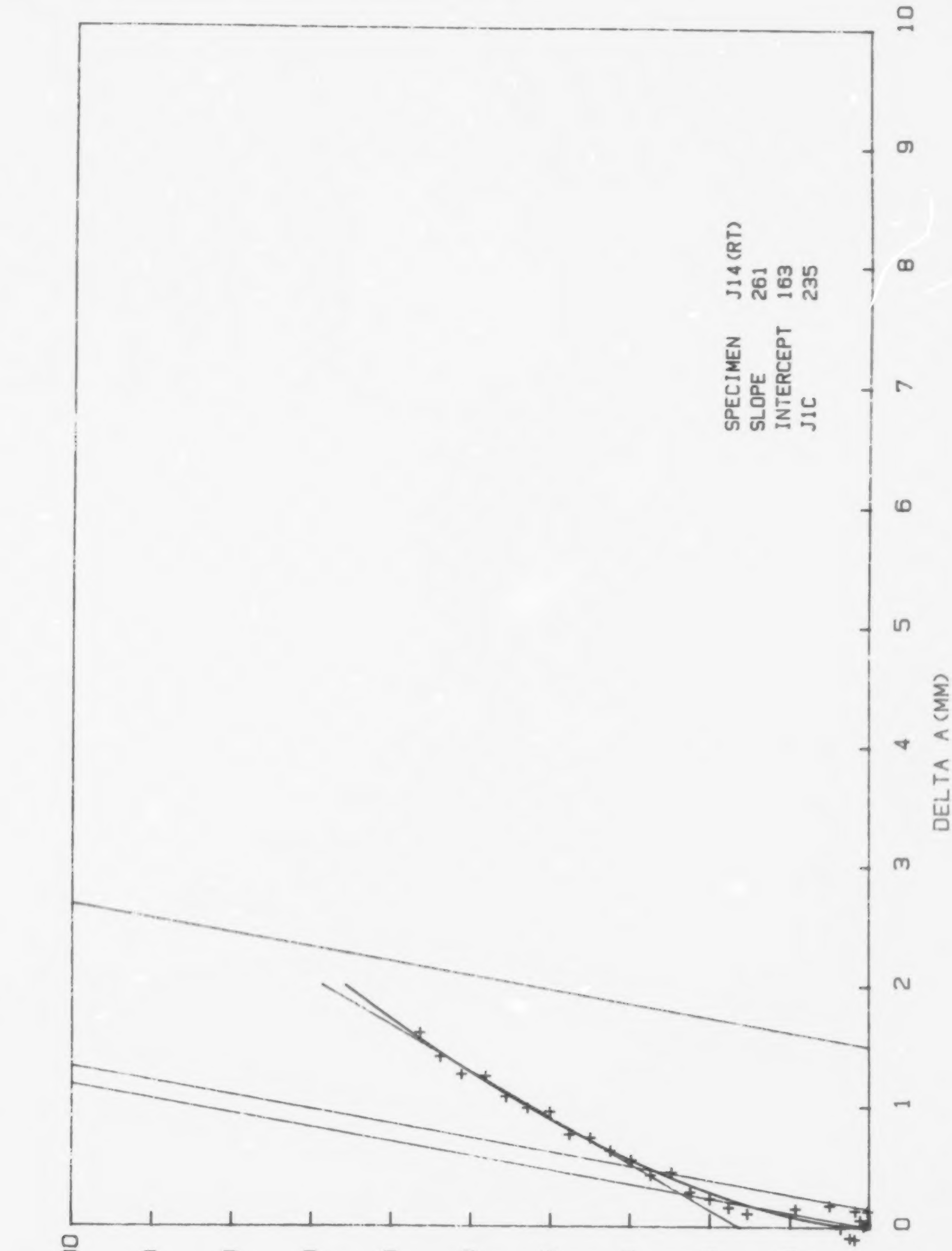
H(M)	D(M)	POISSON'S RATIO
.02384	2.54E-03	.3

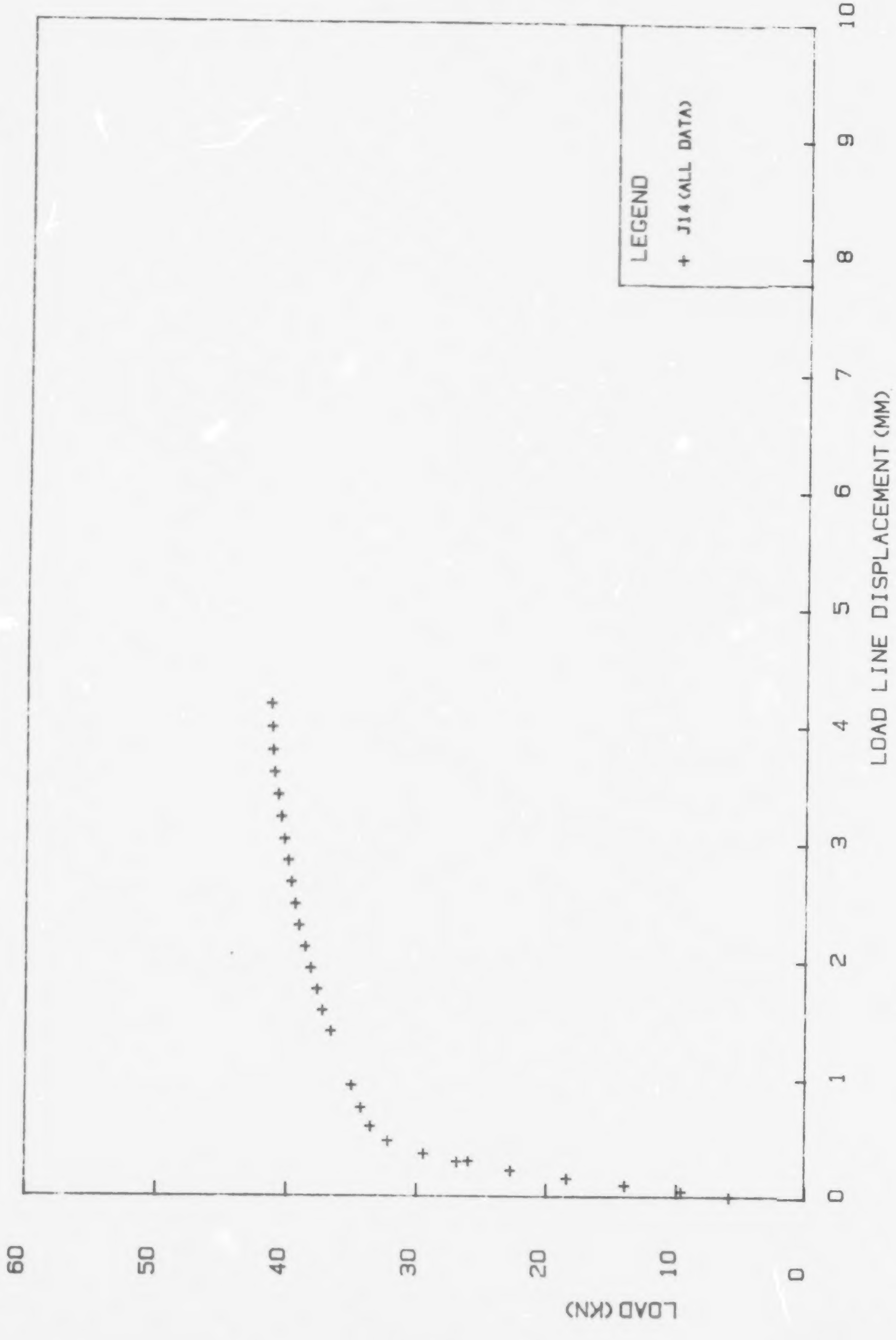
J13

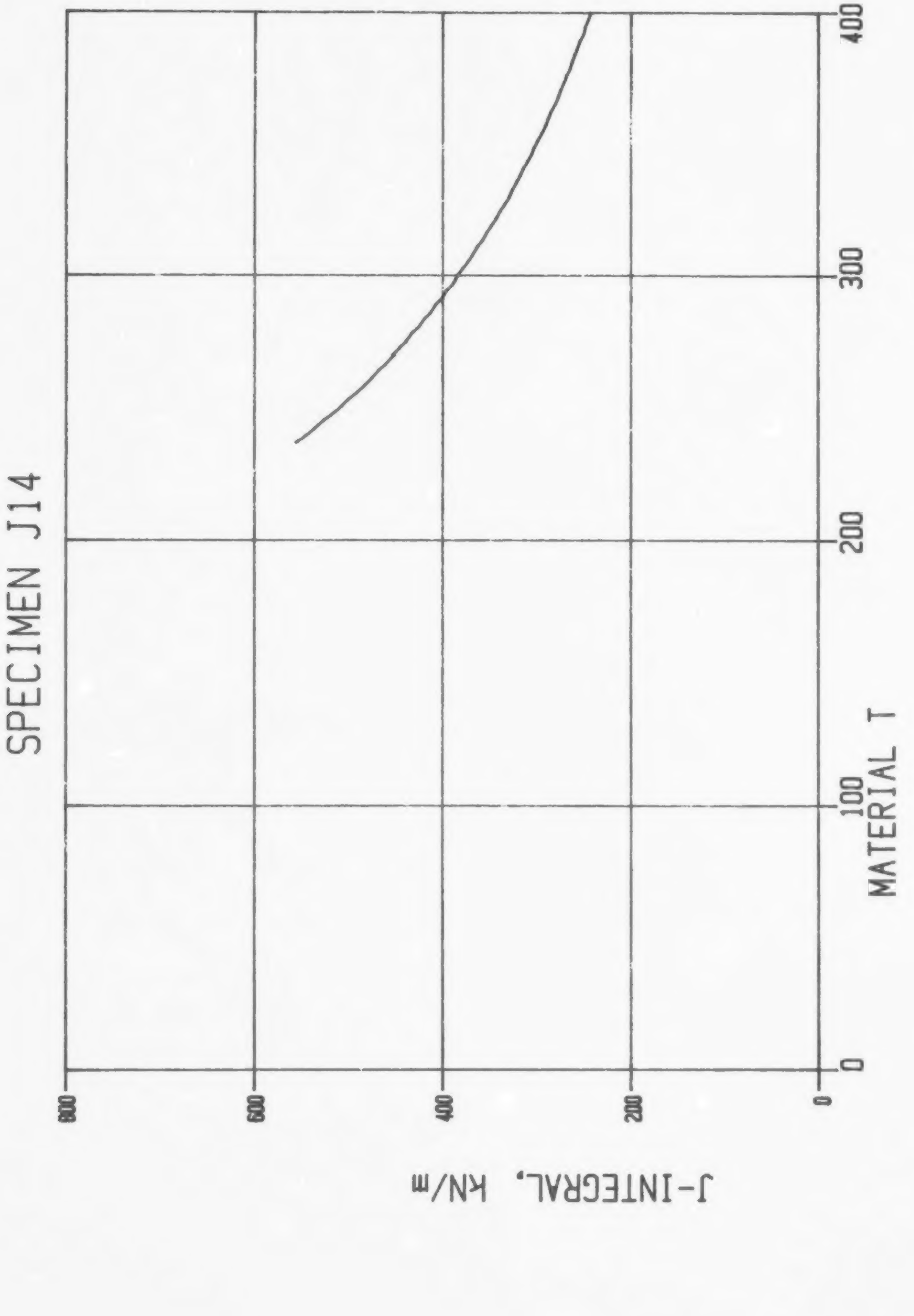
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.2	3.677	3.678	.155	.9982	1
2.66	3.65	3.651	-.112	.9999	2
4.64	3.691	3.692	.302	1	3
7.66	3.676	3.677	.153	.9996	4
11.68	3.661	3.662	3E-03	.9999	5
17.16	3.676	3.678	.158	.9997	6
25.09	3.673	3.676	.135	.9995	7
36.18	3.678	3.68	.185	.9998	8
49.27	3.665	3.668	.064	.9993	9
63.41	3.66	3.665	.027	.9995	10
77.96	3.671	3.676	.14	.9997	11
94.46	3.655	3.661	-9E-03	.9998	12
111.34	3.661	3.668	.055	.9999	13
128.49	3.663	3.671	.088	.9994	14
145.58	3.68	3.689	.268	.9995	15
164.36	3.679	3.688	.261	.9998	16
183.72	3.689	3.699	.368	.9999	17
203.48	3.696	3.708	.455	.9999	18
221.4	3.724	3.735	.734	.9998	19
241.32	3.74	3.752	.903	.9997	20
263.82	3.744	3.757	.952	.9996	21
285.33	3.756	3.77	1.081	.9996	22
307.3	3.772	3.787	1.25	.9999	23
330.22	3.786	3.802	1.4	.9998	24
347.99	3.829	3.846	1.836	.9999	25
366.9	3.864	3.882	2.198	.9999	26
386.64	3.903	3.921	2.594	.9999	27
406.94	3.933	3.952	2.904	.9998	28
421.96	3.98	4	3.382	.9997	29
447.14	3.989	4.01	3.482	.9999	30
463.88	4.033	4.054	3.922	.9998	31
483.84	4.058	4.08	4.179	.9998	32

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J13
1	5.005	0	
2	8.24	.035	
3	12.085	.078	
4	15.869	.123	
5	19.653	.173	
6	23.234	.228	
7	26.55	.295	
8	29.358	.378	
9	31.25	.486	
10	32.715	.602	
11	34.058	.724	
12	35.217	.85	
13	36.194	.978	
14	37.048	1.115	
15	37.903	1.249	
16	38.696	1.388	
17	39.368	1.526	
18	39.795	1.674	
19	40.222	1.821	
20	40.588	1.97	
21	40.894	2.123	
22	40.955	2.281	
23	41.077	2.441	
24	41.077	2.609	
25	40.894	2.781	
26	40.588	2.955	
27	40.222	3.13	
28	39.368	3.318	
29	38.696	3.501	
30	38.269	3.679	
31	37.598	3.865	
32	36.621	4.059	
33	36.133	4.244	

	J(KN/M)	T	W	J13
1	174.04	292.01	27.01	
2	193.6	368.63	30.55	
3	212.44	103.74	7.75	
4	231.36	190.72	13	
5	252.57	742.5	46.27	
6	274.57	268.32	15.3	
7	296.32	210.45	11.05	
8	318.76	246.7	11.97	
9	339.1	65.82	2.95	
10	357.44	84.47	3.54	
11	376.77	80.48	3.14	
12	396.79	105.97	3.88	
13	414.45	50.77	1.74	
14	434.55	408.1	13.31	
15	455.51	61.38	1.87	
16	473.86	125.66	3.64	


SPECIMEN J14(RT)
SLOPE 261
INTERCEPT 163
J1C 235
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J14 (ALL DATA)


SPECIMEN J14
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

              TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J14
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            320.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          532.6
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             3.048
 PERCENT SIDE GROOVE                                  19.356
 SPECIMEN WIDTH W(CM)                                 6.34900001
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.09603917E+11

              FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             22.69
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.872

              CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.965
 INITIAL A/W                                          .61
 AVERAGE CRACK EXTENSION 9PT(CM)                      .168
 DELTA A(CM) COMPLIANCE                               .16
 MAX DEVIATION OF SINGLE MEASUREMENT %                .89

              ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     18
 LAST POINT                      28
 JIC(KN/M)                       235
 CORRELATION COEFF               .98
 SLOPE M(MPa)                    261
 INTERCEPT B (KN/M)              163

              VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

              QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             YES
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      524.11
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    493.96
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.477
 25*JQ/EF.Y.(CM)                                      1.378

              CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        18
 LAST DATA POINT USED       28
 CONSTANT(C1)               429.65
 EXPONENT(C2)               .613
```

J14(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
20.03	1.9	.01	1.91	1.91	2.01	3.886	1
28.83	3.93	.12	4.05	4.05	4.28	3.875	2
37.99	6.83	.56	7.39	7.39	7.8	3.873	3
47.06	10.48	1.49	11.96	11.96	12.6	3.878	4
55.92	14.79	3.44	18.23	18.24	19.12	3.886	5
53.21	13.4	5.54	18.94	18.91	19.71	3.863	6
60.38	17.25	7.67	24.92	24.89	25.93	3.864	7
66.34	20.82	15.7	36.52	36.52	37.73	3.872	8
69.93	23.14	27.32	50.46	50.62	51.75	3.89	9
69.37	22.77	48.7	71.47	70.95	72.98	3.844	10
72.85	25.11	68.09	93.19	93.78	94.57	3.888	11
75.95	27.29	125.88	153.17	153.61	154.77	3.883	12
77.58	28.48	147.97	176.44	177.21	178.09	3.888	13
78.83	29.4	170.76	200.17	201.49	201.82	3.896	14
80.12	30.37	194.02	224.39	226.18	226.07	3.901	15
81.89	31.73	216.04	247.76	251.26	249.43	3.917	16
82.79	32.43	241.48	273.91	277.13	275.64	3.915	17
84.12	33.48	264.88	298.36	303.18	300.08	3.927	18
85.19	34.34	290	324.34	330.24	326.05	3.935	19
86.33	35.26	314.46	349.71	357.28	351.42	3.946	20
87.14	35.92	340.2	376.12	384.14	377.85	3.948	21
88.75	37.27	363.47	400.73	412.16	402.43	3.967	22
89.48	37.88	390.95	428.82	440.88	430.54	3.97	23
90.71	38.93	416.82	455.75	469.79	457.47	3.98	24
92.02	40.06	440.95	481.01	498.89	482.69	3.997	25
92.24	40.25	471.11	511.37	529.58	513.05	3.998	26
93.29	41.17	496.91	538.09	560.03	539.73	4.013	27
94.55	42.29	521.27	563.56	590.86	565.14	4.032	28

H(M)	D(M)	POISSON'S RATIO
.0238	2.54E-03	.3

J14

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.91	3.886	3.886	.138	.9993	1
4.05	3.875	3.875	.031	.9999	2
7.39	3.873	3.873	.015	.9999	3
11.96	3.877	3.878	.063	.9999	4
18.23	3.885	3.886	.141	.9999	5
18.94	3.861	3.863	-.094	.9991	6
24.92	3.862	3.864	-.083	.9982	7
36.52	3.869	3.872	-3E-03	.9993	8
50.46	3.887	3.89	.184	.9961	9
71.47	3.839	3.844	-.284	.991	10
93.19	3.882	3.888	.155	.9998	11
153.17	3.876	3.883	.114	.9998	12
176.44	3.88	3.888	.163	.9997	13
200.17	3.886	3.896	.235	1	14
224.39	3.89	3.901	.287	.9999	15
247.76	3.906	3.917	.453	.9999	16
273.91	3.902	3.915	.428	.9999	17
298.36	3.914	3.927	.554	.9999	18
324.34	3.92	3.935	.63	1	19
349.71	3.93	3.946	.738	.9998	20
376.12	3.932	3.948	.765	.9999	21
400.73	3.949	3.967	.952	.9998	22
428.82	3.952	3.97	.983	.9999	23
455.75	3.96	3.98	1.078	1	24
481.01	3.976	3.997	1.248	.9999	25
511.37	3.976	3.998	1.261	.9999	26
538.09	3.99	4.013	1.407	.9999	27
563.56	4.009	4.032	1.604	.9998	28

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J14
1	5.92	0	
2	9.644	.045	
3	13.977	.098	
4	18.433	.157	
5	22.766	.222	
6	26.917	.295	
7	26.001	.299	
8	29.48	.361	
9	32.227	.469	
10	33.569	.591	
11	34.302	.748	
12	35.034	.94	
13	36.621	1.399	
14	37.292	1.576	
15	37.72	1.755	
16	38.208	1.935	
17	38.635	2.117	
18	39.124	2.297	
19	39.429	2.48	
20	39.734	2.667	
21	39.978	2.853	
22	40.283	3.033	
23	40.527	3.224	
24	40.771	3.413	
25	41.077	3.604	
26	41.199	3.795	
27	41.26	3.992	
28	41.321	4.189	
29	41.321	4.39	

```
        J(KN/M)              T           W     J14

 1          236.08    149.09          14.52
 2          260.84    -1133.11        -99.98
 3          286.14    206.35          16.51
 4          311.35    358.95          26.31
 5          337.02    248.84          16.78
 6          362.92    1054.9          65.97
 7          388.43    139.11          8.07
 8          414.78    935.82          50.74
 9          442.29    302.68          15.33
 10         468.38    156.98          7.45
 11         496.19    2369.32         106.14
 12         524.73    194.23          8.18
 13         550.82    136.73          5.44
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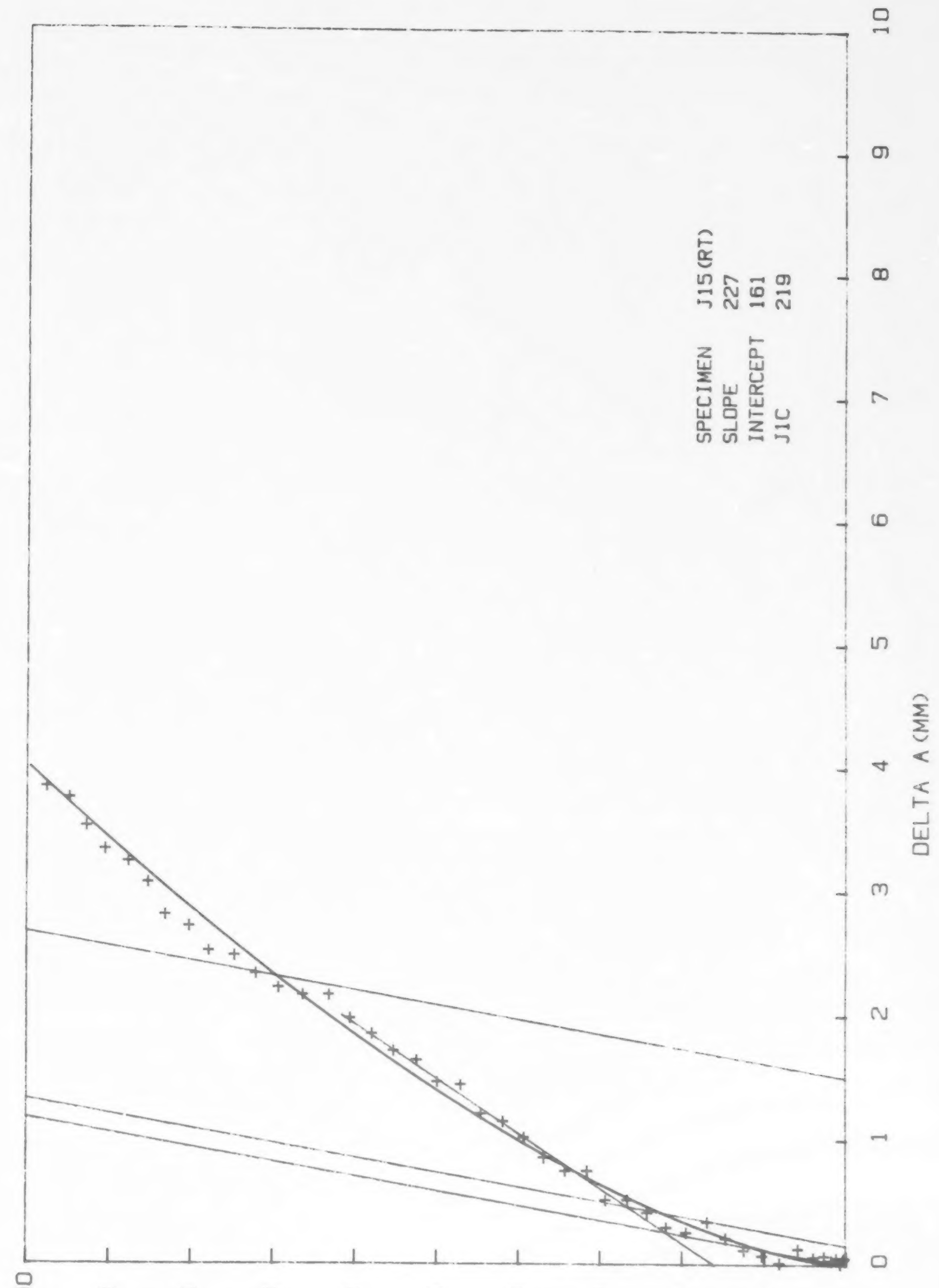
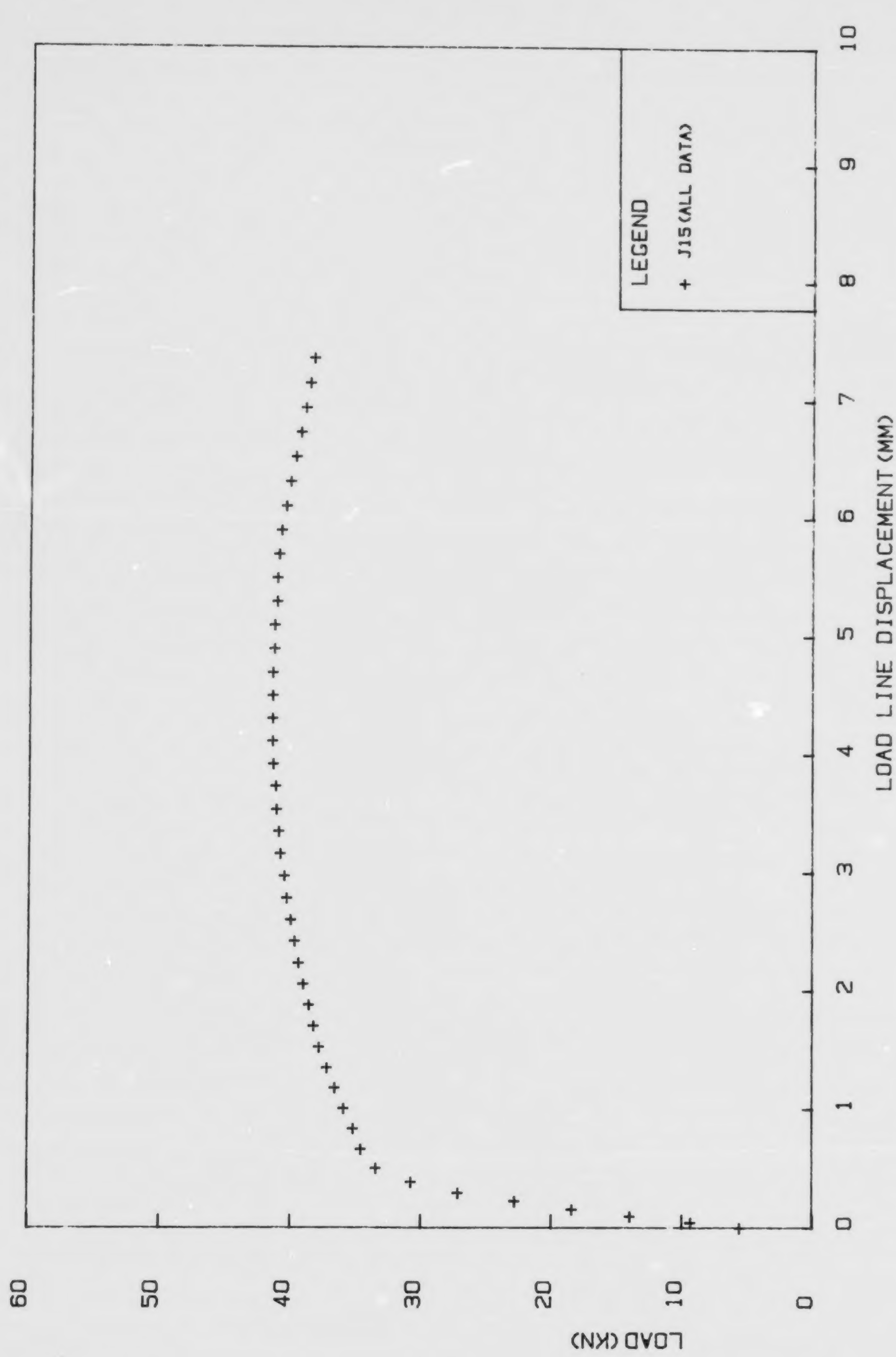
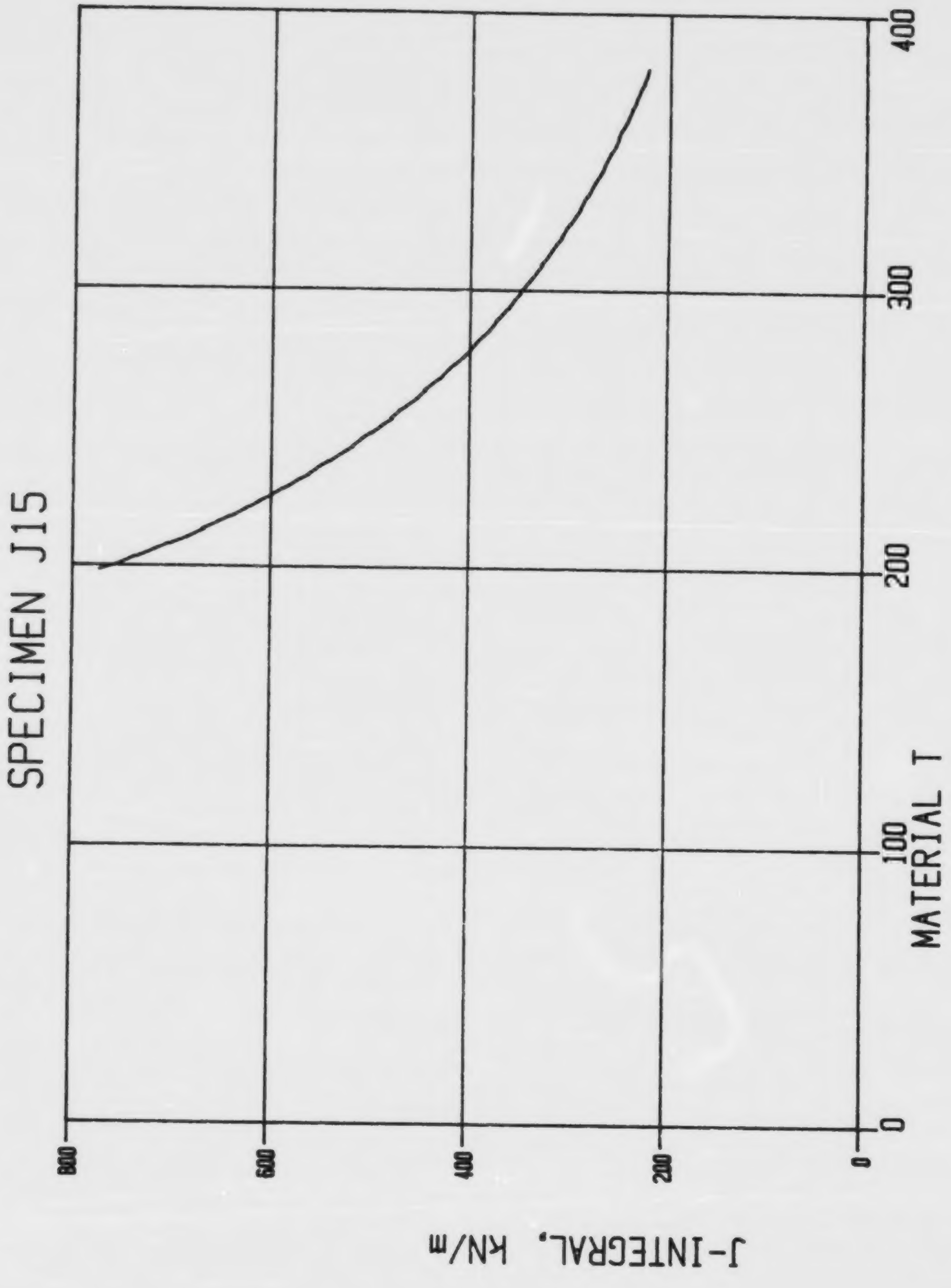

SPECIMEN J15(RT)
SLOPE 227
INTERCEPT 161
J1C 219
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J15 (ALL DATA)


SPECIMEN J15
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J15
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                PARENT
 TEST TEMPERATURE(DEG C)                           20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         320.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       532.6
 CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
 SPECIMEN THICKNESS B(CM)                          3.05
 PERCENT SIDE GROOVE                               19.311
 SPECIMEN WIDTH W(CM)                              6.34900001
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.92346E+11
 EFFECTIVE MODULUS(Pa)                             2.13289165E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          22.33
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.848

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.952
 INITIAL A/W                                       .606
 AVERAGE CRACK EXTENSION 9PT(CM)                   .43
 DELTA A(CM) COMPLIANCE                            .384
 MAX DEVIATION OF SINGLE MEASUREMENT %             .81

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                  17
 LAST POINT                   33
 JIC(KN/M)                    219
 CORRELATION COEFF            .99
 SLOPE M(MPa)                 227
 INTERCEPT B (KN/M)           161

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          YES
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   524.75
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 451.34
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.501
 25*JQ/EF.Y.(CM)                                   1.284

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       17
 LAST DATA POINT USED      44
 CONSTANT(C1)              400.4
 EXPONENT(C2)              .6575
```

J15(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
18.99	1.71	0	1.71	1.71	1.8	3.854	1
28.4	3.82	.01	3.83	3.83	4.06	3.852	2
37.37	6.61	.47	7.08	7.08	7.48	3.849	3
46.42	10.2	1.69	11.89	11.89	12.5	3.854	4
55.16	14.39	3.61	18	18	18.88	3.852	5
62.62	18.55	8.54	27.09	27.1	28.21	3.856	6
68.04	21.9	18.52	40.42	40.42	41.75	3.855	7
70.71	23.65	35.58	59.23	59.3	60.63	3.861	8
71.44	24.14	57.58	81.73	81.58	83.23	3.85	9
73.19	25.34	77.52	102.86	102.89	104.41	3.856	10
74.77	26.45	98.68	125.13	125.34	126.71	3.86	11
76.46	27.66	119.44	147.09	147.78	148.7	3.869	12
78.37	29.05	140.35	169.4	170.91	171.02	3.883	13
78.81	29.39	165.45	194.84	195.7	196.53	3.874	14
79.78	30.11	189.01	219.12	220.35	220.84	3.878	15
81.27	31.25	211.09	242.34	244.74	244.05	3.89	16
82.57	32.25	234.1	266.35	269.88	268.07	3.9	17
83.18	32.73	260.48	293.22	296.68	294.97	3.9	18
85.12	34.28	281.26	315.53	322.27	317.24	3.923	19
85.76	34.79	307.85	342.64	349.36	344.39	3.923	20
86.75	35.6	332.94	368.55	377.02	370.27	3.934	21
88.34	36.92	356.11	393.03	404.39	394.73	3.95	22
89.35	37.77	381.01	418.78	432.57	420.45	3.963	23
90.13	38.43	407.29	445.72	460.82	447.39	3.969	24
91.66	39.75	430.6	470.35	490.53	471.96	3.992	25
92.22	40.23	458.81	499.04	519.78	500.67	3.995	26
93.44	41.3	483.03	524.33	549.39	525.91	4.012	27
93.93	41.74	510.72	552.46	579.57	554.02	4.02	28
94.8	42.52	536.18	578.7	609.62	580.22	4.033	29
95.63	43.27	562.29	605.56	640.24	607.03	4.046	30
96.58	44.13	587.3	631.43	671.91	632.84	4.065	31
96.57	44.12	619.15	663.28	703.71	664.68	4.065	32
96.55	44.1	649	693.11	735.62	694.46	4.071	33
97.31	44.8	675.93	720.72	767.3	722.04	4.082	34
98	45.43	701.51	746.94	798.95	748.2	4.096	35
97.83	45.28	733.07	778.34	831.9	779.56	4.1	36
98.32	45.74	756.51	802.25	864.01	803.37	4.12	37
98.21	45.63	785.72	831.35	896.98	832.4	4.129	38
99.02	46.38	806	852.38	929.76	853.33	4.155	39
99.33	46.68	829.83	876.5	961.81	877.37	4.172	40
99.11	46.47	858.45	904.92	994.91	905.69	4.182	41
99.72	47.04	880.93	927.97	1027.42	928.67	4.201	42
100.59	47.87	900.88	948.75	1059.74	949.38	4.223	43
100.47	47.76	928.84	976.6	1092.37	977.15	4.232	44

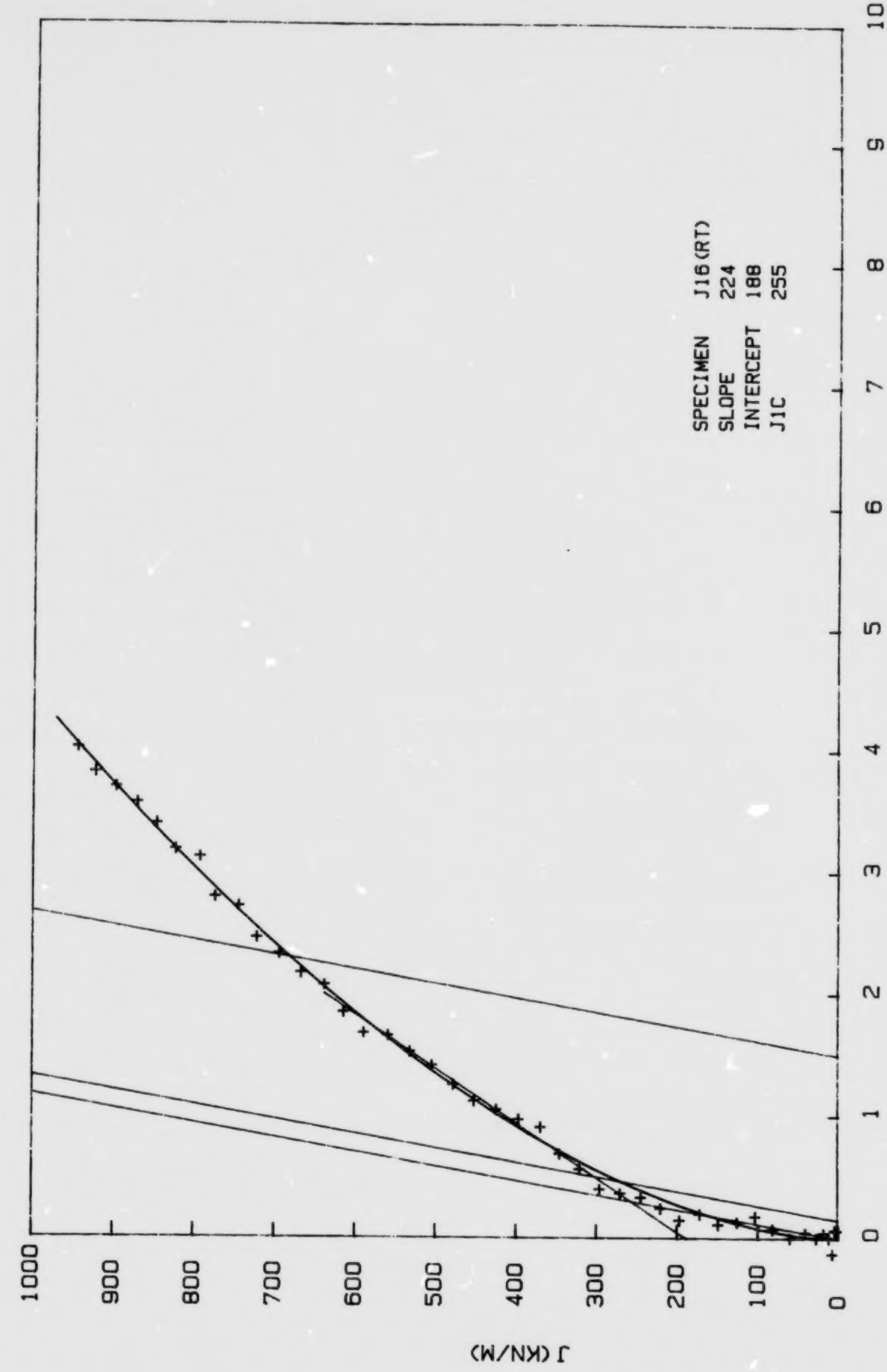
H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

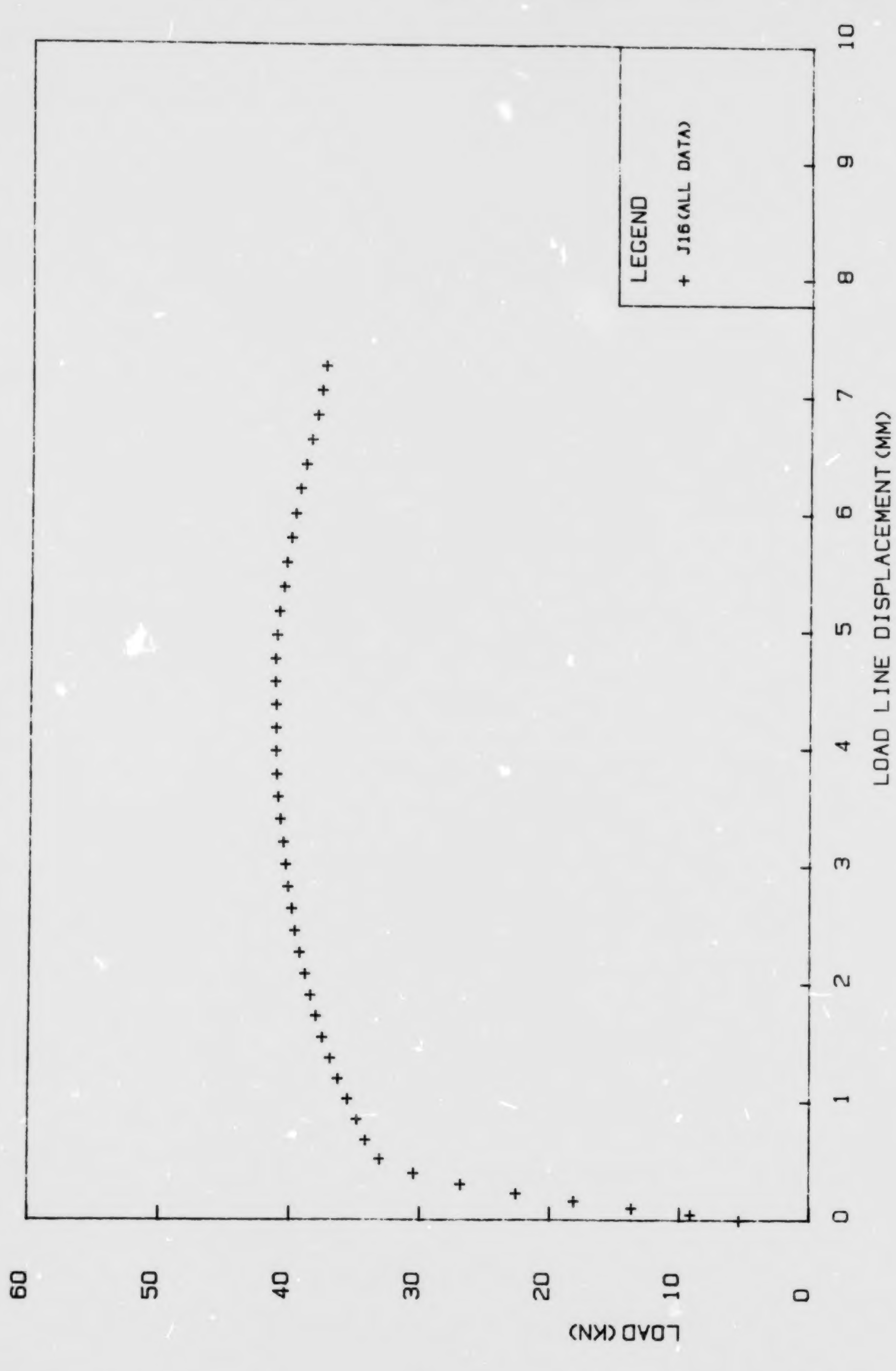
J15

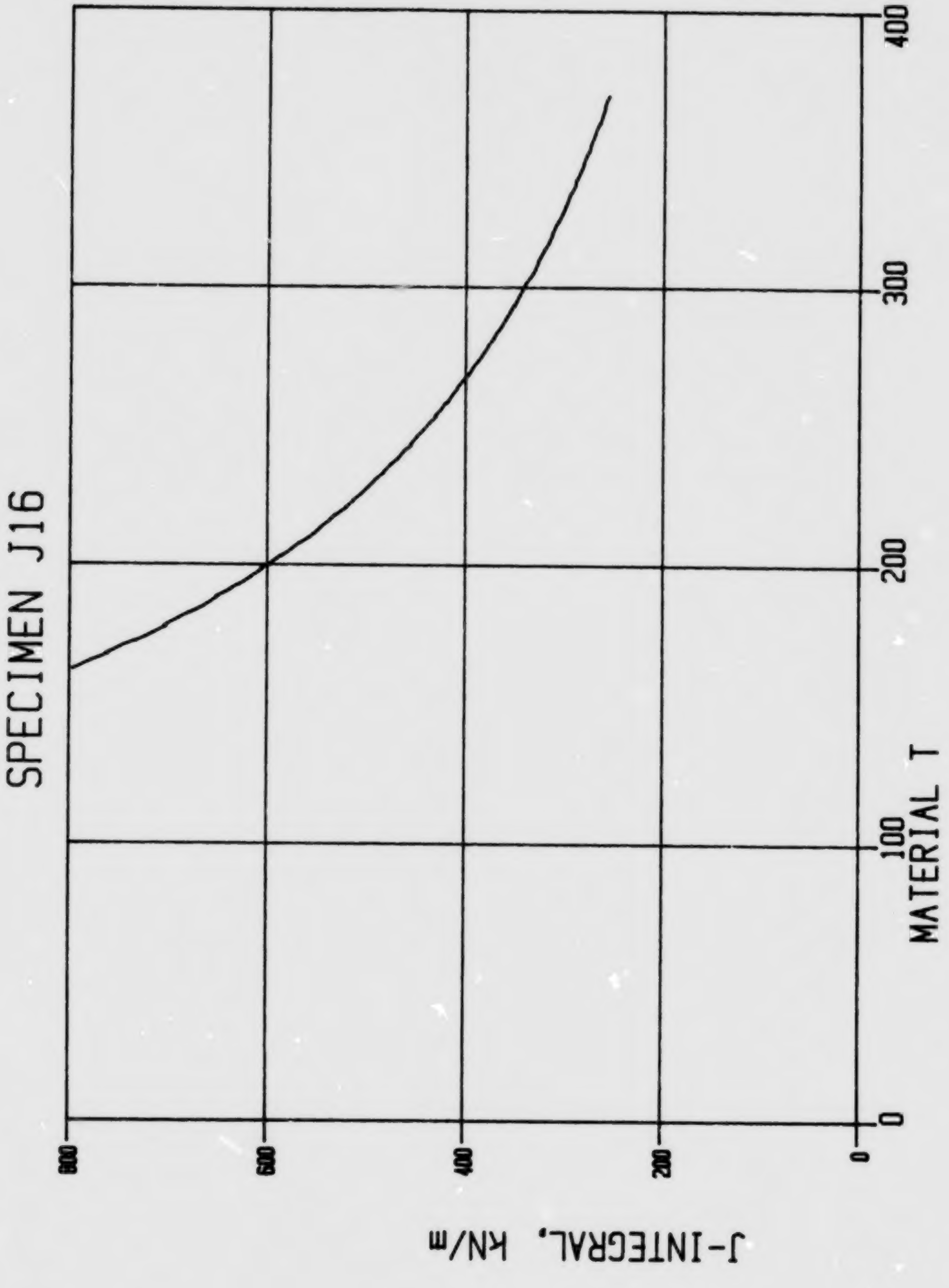
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.71	3.854	3.854	.058	.9986	1
3.83	3.852	3.852	.045	.9999	2
7.08	3.848	3.849	.012	.9995	3
11.89	3.853	3.854	.06	.9996	4
18	3.85	3.852	.038	1	5
27.09	3.853	3.856	.076	.9999	6
40.42	3.852	3.855	.065	.9999	7
59.23	3.858	3.861	.133	.9998	8
81.73	3.845	3.85	.019	.9999	9
102.86	3.85	3.856	.077	.9998	10
125.13	3.854	3.86	.122	.9998	11
147.09	3.862	3.869	.215	.9999	12
169.4	3.874	3.883	.346	1	13
194.84	3.864	3.874	.259	.9999	14
219.12	3.868	3.878	.3	.9999	15
242.34	3.878	3.89	.419	.9999	16
266.35	3.888	3.9	.52	.9999	17
293.22	3.886	3.9	.515	.9997	18
315.53	3.909	3.923	.753	.9999	19
342.64	3.908	3.923	.752	.9997	20
368.55	3.917	3.934	.859	.9998	21
393.03	3.933	3.95	1.022	.9999	22
418.78	3.944	3.963	1.149	.9999	23
445.72	3.95	3.969	1.213	.9999	24
470.35	3.972	3.992	1.444	.9999	25
499.04	3.973	3.995	1.467	.9998	26
524.33	3.99	4.012	1.64	.9998	27
552.46	3.996	4.02	1.718	.9999	28
578.7	4.009	4.033	1.854	.9999	29
605.56	4.021	4.046	1.981	.9998	30
631.43	4.038	4.065	2.167	.9998	31
663.28	4.037	4.065	2.166	.9999	32
693.11	4.042	4.071	2.226	.9997	33
720.72	4.052	4.082	2.338	.9998	34
746.94	4.065	4.096	2.481	.9999	35
778.34	4.068	4.1	2.52	.9997	36
802.25	4.087	4.12	2.719	.9998	37
831.35	4.095	4.129	2.809	.9997	38
852.38	4.121	4.155	3.071	.9999	39
876.5	4.137	4.172	3.242	.9998	40
904.92	4.145	4.182	3.339	.9998	41
927.97	4.164	4.201	3.529	.9999	42
948.75	4.185	4.223	3.753	.9998	43
976.6	4.193	4.232	3.843	.9998	44

```
          LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J15
 1         5.554         0
 2         9.338         .044
 3         13.977        .098
 4         18.433        .156
 5         22.827        .225
 6         27.161        .295
 7         30.762        .386
 8         33.447        .503
 9         34.607        .659
 10        35.217        .835
 11        35.95         1.003
 12        36.621        1.177
 13        37.231        1.348
 14        37.842        1.521
 15        38.269        1.699
 16        38.635        1.877
 17        39.063        2.053
 18        39.429        2.231
 19        39.734        2.417
 20        40.039        2.598
 21        40.344        2.781
 22        40.527        2.969
 23        40.833        3.154
 24        40.955        3.342
 25        41.138        3.528
 26        41.199        3.726
 27        41.382        3.914
 28        41.443        4.106
 29        41.443        4.299
 30        41.443        4.492
 31        41.443        4.687
 32        41.321        4.89
 33        41.321        5.088
 34        41.138        5.288
 35        41.138        5.488
 36        41.016        5.688
 37        40.833        5.894
 38        40.466        6.099
 39        40.161        6.306
 40        39.734        6.519
 41        39.368        6.724
 42        39.001        6.934
 43        38.696        7.144
 44        38.391        7.354
 45        38.086        7.561
```

	J(KN/M)	T	W	J15
1	206.98	615	69.42	
2	230.73	207.57	20.92	
3	254.35	250.54	22.81	
4	279.79	-6019.76	-498.29	
5	304.38	99.14	7.47	
6	329.09	-18592.52	-1295.8	
7	355.59	255.94	16.44	
8	380.79	159.12	9.48	
9	405.9	213.88	11.89	
10	432.25	447.21	23.28	
11	458.03	112.8	5.49	
12	484.7	1276.1	58.6	
13	511.69	154.73	6.68	
14	538.4	383.5	15.69	
15	565.58	204.42	7.91	
16	592.13	223.08	8.2	
17	618.5	147.05	5.13	
18	647.35	-29068.75	-969.87	
19	678.19	523.84	16.64	
20	706.91	260.78	7.91	
21	733.83	193.53	5.62	
22	762.64	850.35	23.71	
23	790.3	127.4	3.4	
24	816.8	342.82	8.81	
25	841.87	84.76	2.09	
26	864.44	149.22	3.55	
27	890.71	308.53	7.1	
28	916.45	128.7	2.85	
29	938.36	98.12	2.1	
30	962.68	327.27	6.8	


SPECIMEN J16(RT)
SLOPE 224
INTERCEPT 188
J1C 255
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J16 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J16
J-INTEGRAL, kN/m
MATERIAL T
0
200
400
600
800
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

 SPECIMEN NUMBER                                  J16
 MATERIAL TYPE                                    A106B
 MATERIAL CONDITION                               PARENT
 TEST TEMPERATURE(DEG C)                          20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        320.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      532.6
 CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
 SPECIMEN THICKNESS B(CM)                         3.05
 PERCENT SIDE GROOVE                              19.344
 SPECIMEN WIDTH W(CM)                             6.34900001
 YOUNGS MODULUS AT TEST TEMP(Pa)                  1.92346E+11
 EFFECTIVE MODULUS(Pa)                            2.13216824E+11

                  FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN            12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         22.56
 INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.864

                  CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                   3.968
 INITIAL A/W                                      .609
 AVERAGE CRACK EXTENSION 9PT(CM)                  .435
 DELTA A(CM) COMPLIANCE                           .402
 MAX DEVIATION OF SINGLE MEASUREMENT %            .78

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   19
 LAST POINT                    32
 JIC(KN/M)                     255
 CORRELATION COEFF             .99
 SLOPE M(MPa)                  224
 INTERCEPT B (KN/M)            188

                  VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD      YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD         YES

                  QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                         YES
 CRACK SIZE DA<0.15*DELTA A                       YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  524.53
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                444.16
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 2.485
 25*JQ/EF.Y.(CM)                                  1.495

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      19
 LAST DATA POINT USED     43
 CONSTANT(C1)             419.94
 EXPONENT(C2)             .5806
```

J16(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
18.82	1.68	.07	1.75	1.75	1.84	3.871	1
28.11	3.74	.1	3.84	3.84	4.06	3.871	2
36.82	6.41	.68	7.09	7.09	7.5	3.852	3
46.24	10.12	1.5	11.62	11.62	12.23	3.865	4
55.13	14.38	3.69	18.07	18.07	18.94	3.869	5
62.36	18.4	9.07	27.47	27.47	28.61	3.864	6
67.93	21.83	19.05	40.88	40.9	42.21	3.869	7
69.98	23.17	37.33	60.5	60.47	61.94	3.864	8
71.7	24.32	57.41	81.72	81.84	83.19	3.872	9
73.69	25.69	77.51	103.2	103.63	104.69	3.882	10
74.98	26.59	99.14	125.74	125.98	127.32	3.877	11
76.13	27.42	121.43	148.85	148.97	150.49	3.875	12
77.83	28.66	143.06	171.71	172.4	173.38	3.884	13
78.57	29.21	167.79	197	197.28	198.73	3.879	14
79.95	30.24	189.98	220.22	221.36	221.96	3.889	15
81.29	31.27	213.22	244.48	246.5	246.23	3.897	16
82.37	32.1	237.97	270.08	272.49	271.85	3.901	17
83.32	32.84	263.11	295.96	298.79	297.76	3.904	18
84.73	33.96	286.58	320.54	325.67	322.31	3.921	19
86.07	35.05	310.55	345.61	352.64	347.36	3.933	20
87.7	36.39	332.95	369.34	379.97	371.05	3.955	21
88.48	37.03	359.7	396.73	408.51	398.44	3.961	22
89.48	37.88	386.75	424.63	437.95	426.32	3.969	23
90.29	38.57	413.61	452.18	466.93	453.87	3.976	24
91.38	39.51	438.56	478.07	495.86	479.73	3.99	25
92.48	40.46	464.11	504.57	526.07	506.19	4.005	26
93.2	41.1	490.75	531.84	556.26	533.42	4.017	27
94.03	41.83	517.18	559.01	586.91	560.54	4.03	28
94.3	42.07	547.18	589.25	617.74	590.78	4.032	29
95.41	43.07	571.34	614.41	648.05	615.89	4.049	30
96.62	44.17	594.13	638.3	679.07	639.72	4.071	31
96.84	44.37	622.82	667.19	711.18	668.54	4.081	32
97.04	44.55	649.71	694.26	743.75	695.52	4.097	33
97.51	44.99	677.42	722.41	776.76	723.59	4.11	34
98.42	45.82	699.14	744.97	809.19	746.05	4.136	35
98.2	45.62	728.83	774.45	841.7	775.46	4.143	36
99.65	46.98	746.03	793.01	874.02	793.95	4.176	37
99.01	46.38	776.91	823.29	906.95	824.13	4.182	38
99.45	46.8	799.74	846.53	939.68	847.28	4.203	39
99.62	46.95	824	870.95	972.13	871.58	4.221	40
99.79	47.11	850.07	897.18	1004.68	897.73	4.234	41
99.88	47.2	876.1	923.29	1036.82	923.76	4.246	42
100.45	47.73	897.31	945.05	1069.19	945.43	4.266	43

H(M)	D(M)	POISSON´S RATIO
.0238	2.54E-03	.3

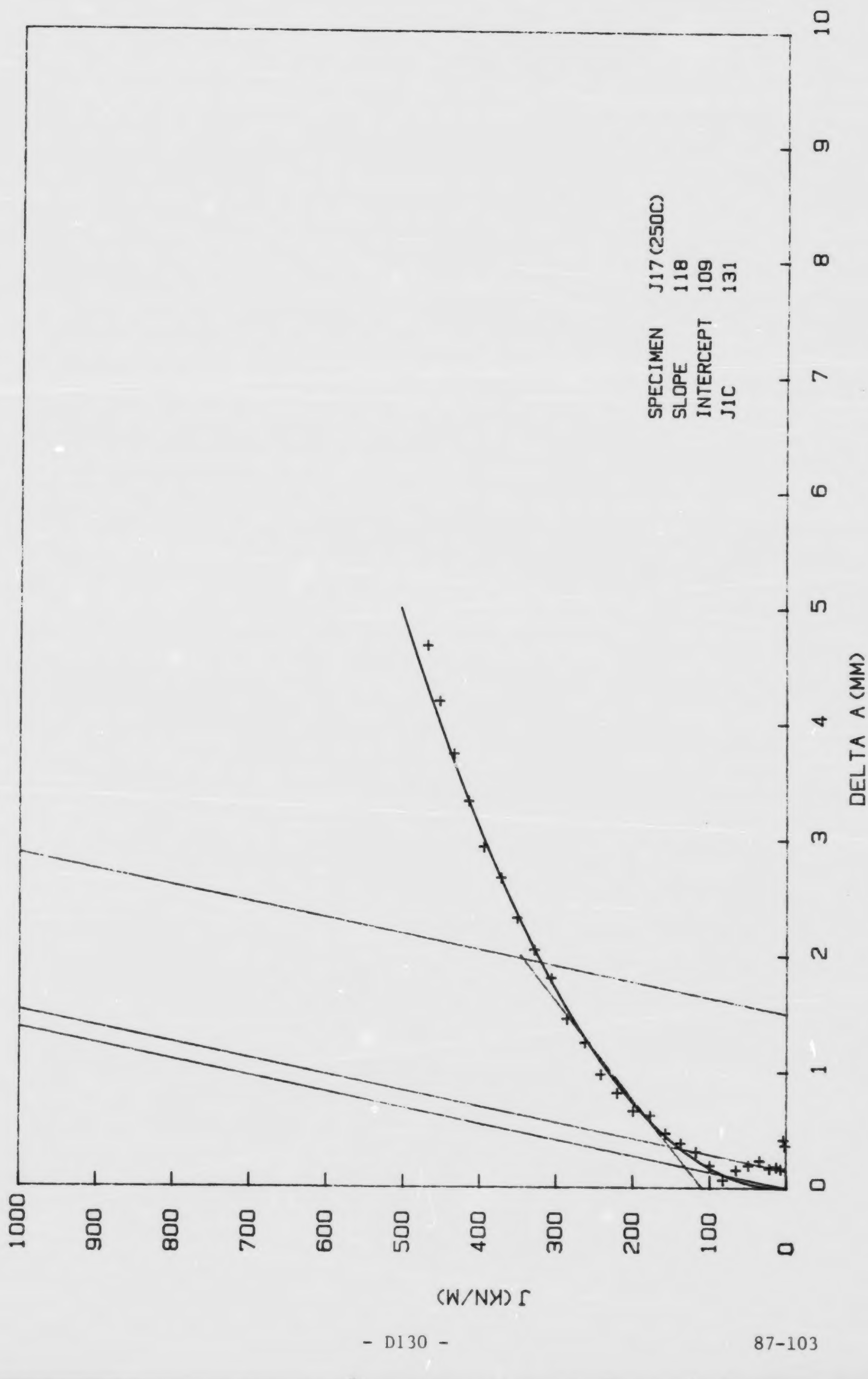
J16

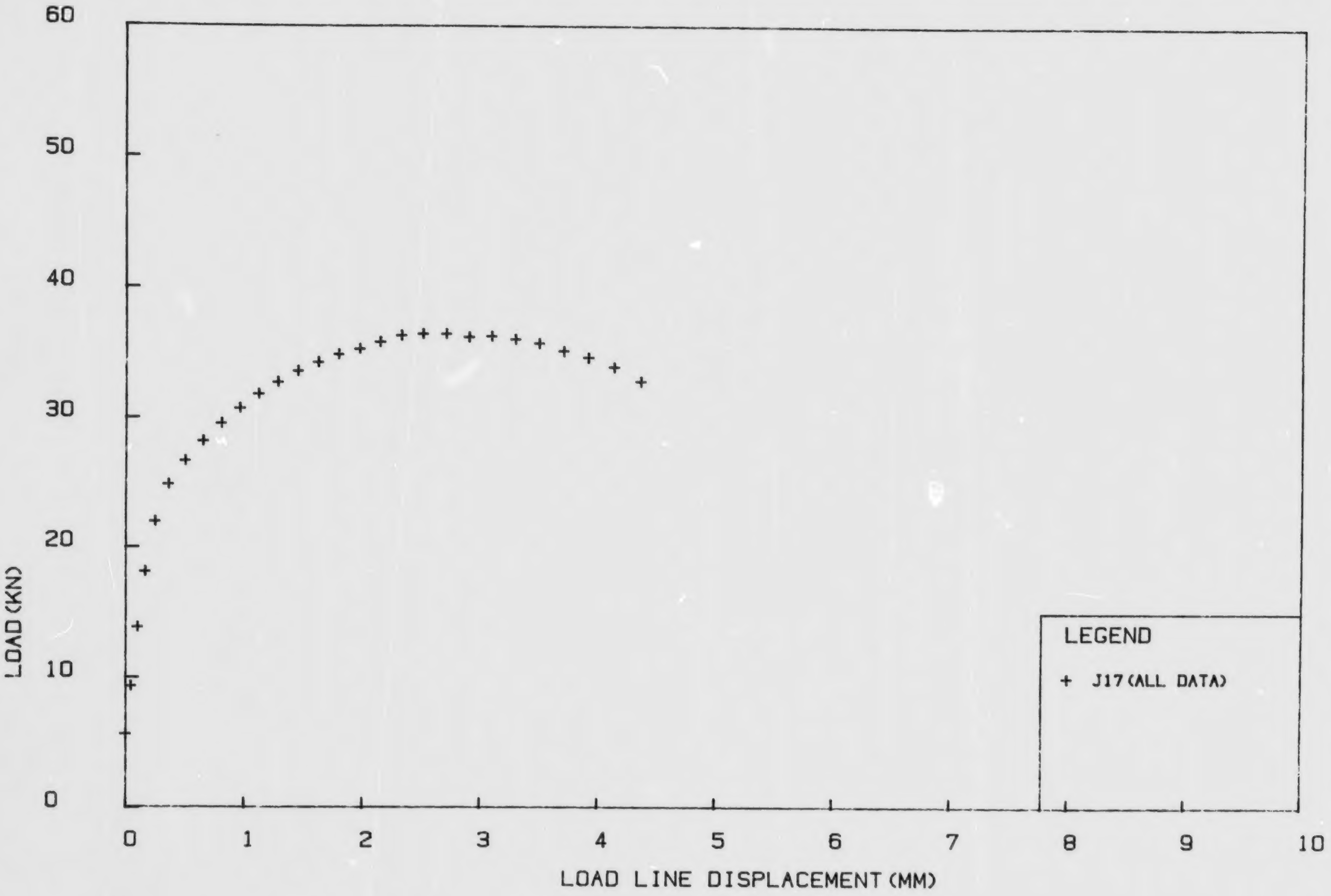
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.75	3.87	3.871	.067	.9996	1
3.84	3.871	3.871	.071	1	2
7.09	3.851	3.852	-.123	.9998	3
11.62	3.863	3.865	6E-03	.9999	4
18.07	3.867	3.869	.046	.9999	5
27.47	3.862	3.864	5E-03	.9999	6
40.88	3.866	3.869	.05	1	7
60.5	3.861	3.864	4E-03	.9998	8
81.72	3.867	3.872	.079	.9995	9
103.2	3.877	3.882	.183	.9998	10
125.74	3.871	3.877	.135	.9999	11
148.85	3.868	3.875	.113	.9998	12
171.71	3.876	3.884	.201	.9999	13
197	3.869	3.879	.148	.9998	14
220.22	3.878	3.889	.246	.9999	15
244.48	3.886	3.897	.333	.9998	16
270.08	3.888	3.901	.369	.9999	17
295.96	3.891	3.904	.402	.9994	18
320.54	3.906	3.921	.567	.9999	19
345.61	3.918	3.933	.692	.9992	20
369.34	3.938	3.955	.909	.9993	21
396.73	3.944	3.961	.973	.9999	22
424.63	3.951	3.969	1.053	.9999	23
452.18	3.956	3.976	1.121	.9999	24
478.07	3.969	3.99	1.257	.9998	25
504.57	3.984	4.005	1.413	.9999	26
531.84	3.994	4.017	1.528	.9999	27
559.01	4.006	4.03	1.657	.9999	28
589.25	4.007	4.032	1.678	.9999	29
614.41	4.023	4.049	1.849	.9997	30
638.3	4.045	4.071	2.074	.9999	31
667.19	4.053	4.081	2.171	.9999	32
694.26	4.068	4.097	2.328	.9997	33
722.41	4.08	4.11	2.461	.9998	34
744.97	4.105	4.136	2.718	.9999	35
774.45	4.112	4.143	2.794	.9999	36
793.01	4.144	4.176	3.123	.9998	37
823.29	4.149	4.182	3.184	.9997	38
846.53	4.169	4.203	3.395	.9999	39
870.95	4.186	4.221	3.566	.9999	40
897.18	4.198	4.234	3.696	.9999	41
923.29	4.209	4.246	3.816	.9999	42
945.05	4.228	4.266	4.019	.9998	43

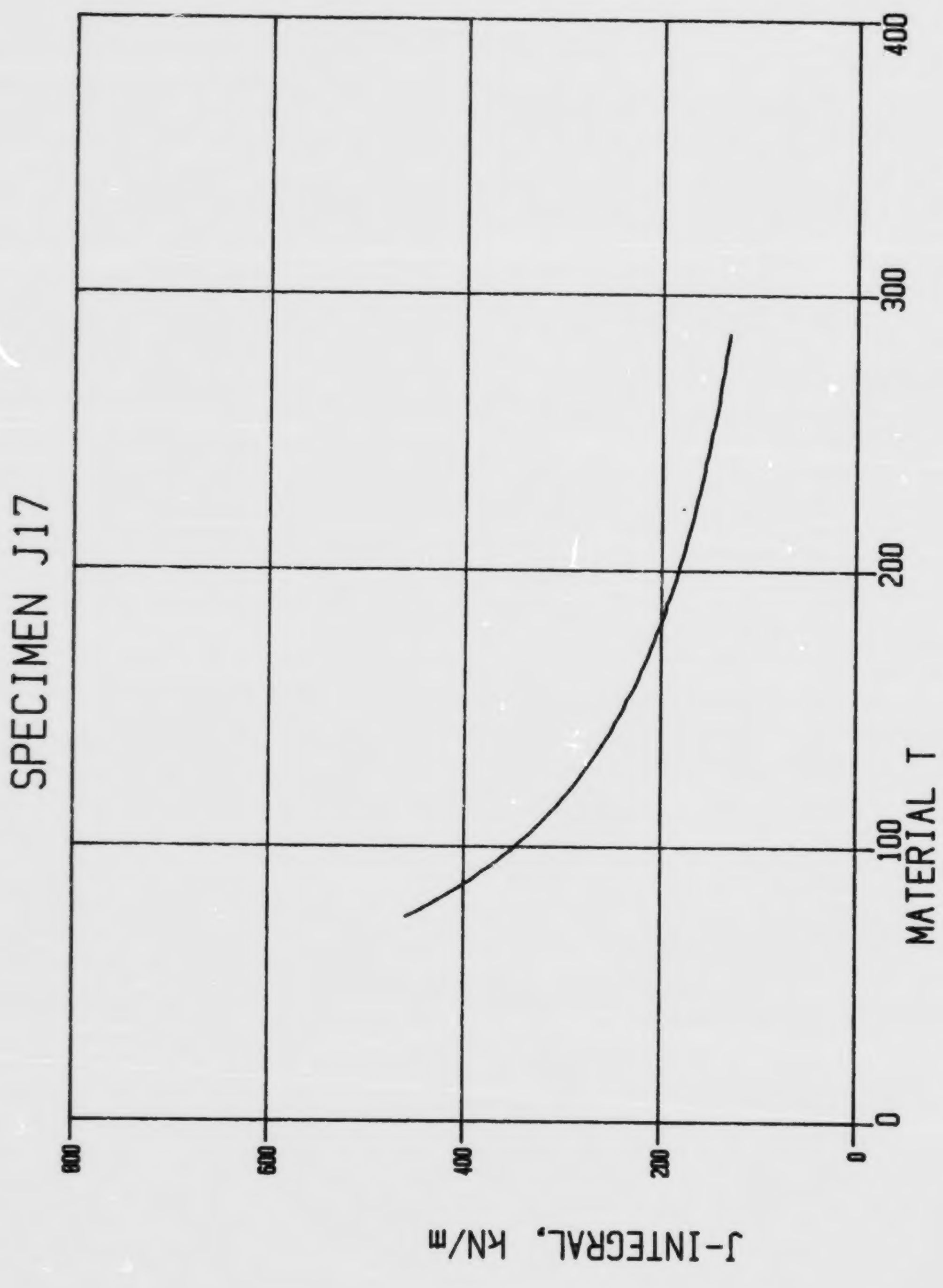
J16

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	5.371	0
2	9.155	.049
3	13.672	.103
4	18.127	.161
5	22.583	.227
6	26.855	.303
7	30.457	.396
8	33.081	.515
9	34.18	.676
10	34.851	.85
11	35.583	1.023
12	36.316	1.194
13	36.926	1.367
14	37.537	1.543
15	38.025	1.724
16	38.452	1.899
17	38.879	2.08
18	39.307	2.263
19	39.673	2.446
20	39.917	2.634
21	40.222	2.82
22	40.405	3.008
23	40.588	3.198
24	40.833	3.394
25	41.016	3.584
26	41.138	3.774
27	41.199	3.972
28	41.199	4.167
29	41.199	4.365
30	41.26	4.561
31	41.26	4.756
32	41.138	4.956
33	40.955	5.159
34	40.588	5.366
35	40.405	5.576
36	40.039	5.786
37	39.734	5.991
38	39.368	6.204
39	38.94	6.411
40	38.513	6.624
41	38.086	6.833
42	37.781	7.043
43	37.476	7.251
44	37.109	7.463

	J(KN/M)	T	W	J16
1	257.28	766.74	68.98	
2	283.02	821.95	67.13	
3	308.25	157.92	11.76	
4	333.07	212.14	14.55	
5	357.47	115.73	7.33	
6	383.04	451.19	26.59	
7	410.68	368.99	20.22	
8	438.4	426.16	21.81	
9	465.12	201.54	9.67	
10	491.32	179.97	8.12	
11	518.21	251.25	10.69	
12	545.43	222.21	8.93	
13	574.13	1529.54	58.37	
14	601.83	155.77	5.63	
15	626.35	112.25	3.86	
16	652.74	315.24	10.36	
17	680.72	182.07	5.7	
18	708.34	224.13	6.7	
19	733.69	92.76	2.65	
20	759.71	411.11	11.28	
21	783.73	59.59	1.56	
22	808.15	522.73	13.25	
23	834.91	117.03	2.84	
24	858.74	150.44	3.53	
25	884.06	213.21	4.82	
26	910.23	231.06	5.05	
27	934.17	113.05	2.38	


SPECIMEN J17(250C)
SLOPE 118
INTERCEPT 109
J1C 131
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J17 (ALL DATA)


SPECIMEN J17
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                  J17
 MATERIAL TYPE                                    A106B
 MATERIAL CONDITION                               PARENT
 TEST TEMPERATURE(DEG C)                          250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        220.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      508.5
 CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
 SPECIMEN THICKNESS B(CM)                         3.049
 PERCENT SIDE GROOVE                              19.317
 SPECIMEN WIDTH W(CM)                             6.347
 YOUNGS MODULUS AT TEST TEMP(Pa)                  1.82776E+11
 EFFECTIVE MODULUS(Pa)                            2.01675416E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN            12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         21.9
 INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.814

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                   3.944
 INITIAL A/W                                      .601
 AVERAGE CRACK EXTENSION 9PT(CM)                  .466
 DELTA A(CM) COMPLIANCE                           .467
 MAX DEVIATION OF SINGLE MEASUREMENT %            1.38

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                        12
 LAST POINT                         20
 JIC(KN/M)                          131
 CORRELATION COEFF                  .95
 SLOPE M(MPa)                       118
 INTERCEPT B (KN/M)                 109

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD           YES
 LIGAMENT>25JIC/EFFECTIVE YIELD     YES
 DJ/DA<EFFECTIVE YIELD              YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                         YES
 CRACK SIZE DA<0.15*DELTA A                       YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  448.46
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                376.58
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 2.533
 25*JQ/EF.Y.(CM)                                  .898

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        12
 LAST DATA POINT USED       28
 CONSTANT(C1)               232.33
 EXPONENT(C2)               .4819
```

J17(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
18.98	1.79	0	1.79	1.79	1.84	3.851	1
28.25	3.97	.07	4.04	4.04	4.22	3.856	2
36.38	6.59	1.02	7.61	7.61	7.97	3.831	3
44.15	9.7	3.64	13.34	13.34	13.9	3.833	4
49.87	12.38	10.09	22.47	22.47	23.19	3.831	5
53.77	14.39	20.97	35.36	35.4	36.18	3.838	6
56.7	16	33.96	49.97	49.95	50.9	3.834	7
59.25	17.48	48.5	65.98	65.89	67.01	3.83	8
61.25	18.68	64.46	83.14	82.84	84.29	3.821	9
63.93	20.35	79.7	100.06	100.17	101.25	3.834	10
66.26	21.86	96.27	118.13	118.73	119.36	3.845	11
68.3	23.22	114.49	137.71	138.67	138.99	3.853	12
70.04	24.43	133.36	157.79	159.27	159.09	3.861	13
71.99	25.8	151.98	177.78	180.32	179.09	3.877	14
73.05	26.57	173.27	199.84	202.69	201.17	3.88	15
74.93	27.95	192.74	220.7	224.96	222.04	3.896	16
76.73	29.32	212.8	242.11	248	243.45	3.912	17
78.36	30.57	232.37	262.95	271.9	264.22	3.939	18
79.43	31.41	254.98	286.39	297.9	287.58	3.96	19
80.77	32.48	274.3	306.78	323.1	307.85	3.995	20
82.24	33.67	295.24	328.91	348.86	329.92	4.019	21
83.23	34.49	317	351.49	375.88	352.38	4.046	22
84.52	35.56	336.9	372.46	402.9	373.23	4.081	23
84.65	35.67	359.74	395.41	430.9	396.02	4.107	24
85.86	36.7	378.21	414.91	458.43	415.37	4.147	25
86.59	37.33	397.45	434.77	487.18	435.05	4.188	26
86.66	37.39	416.3	453.7	516.63	453.73	4.233	27
87.55	38.16	431.67	469.82	544.6	469.69	4.281	28

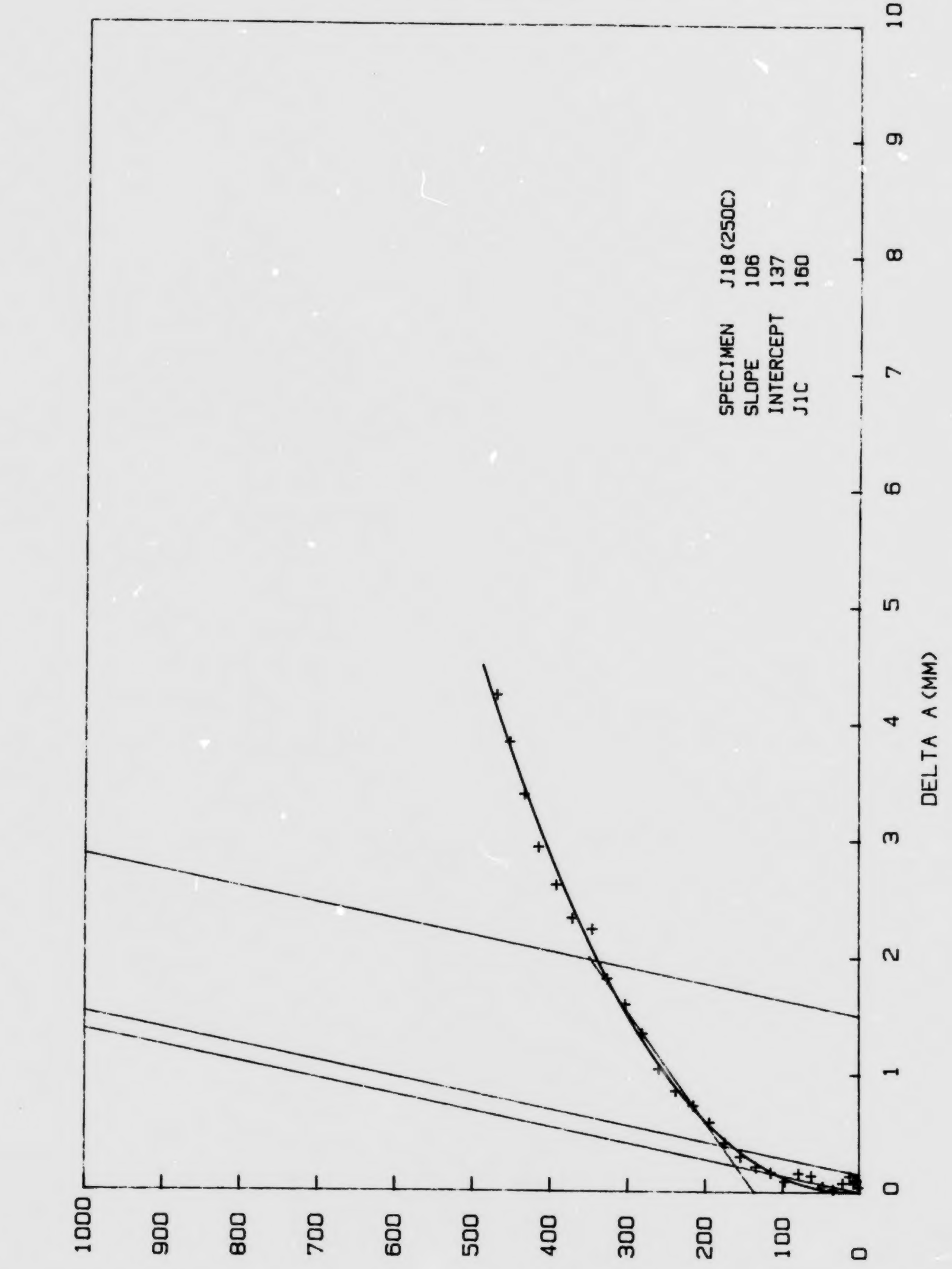
H(M)	D(M)	POISSON'S RATIO
.02385	2.54E-03	.3

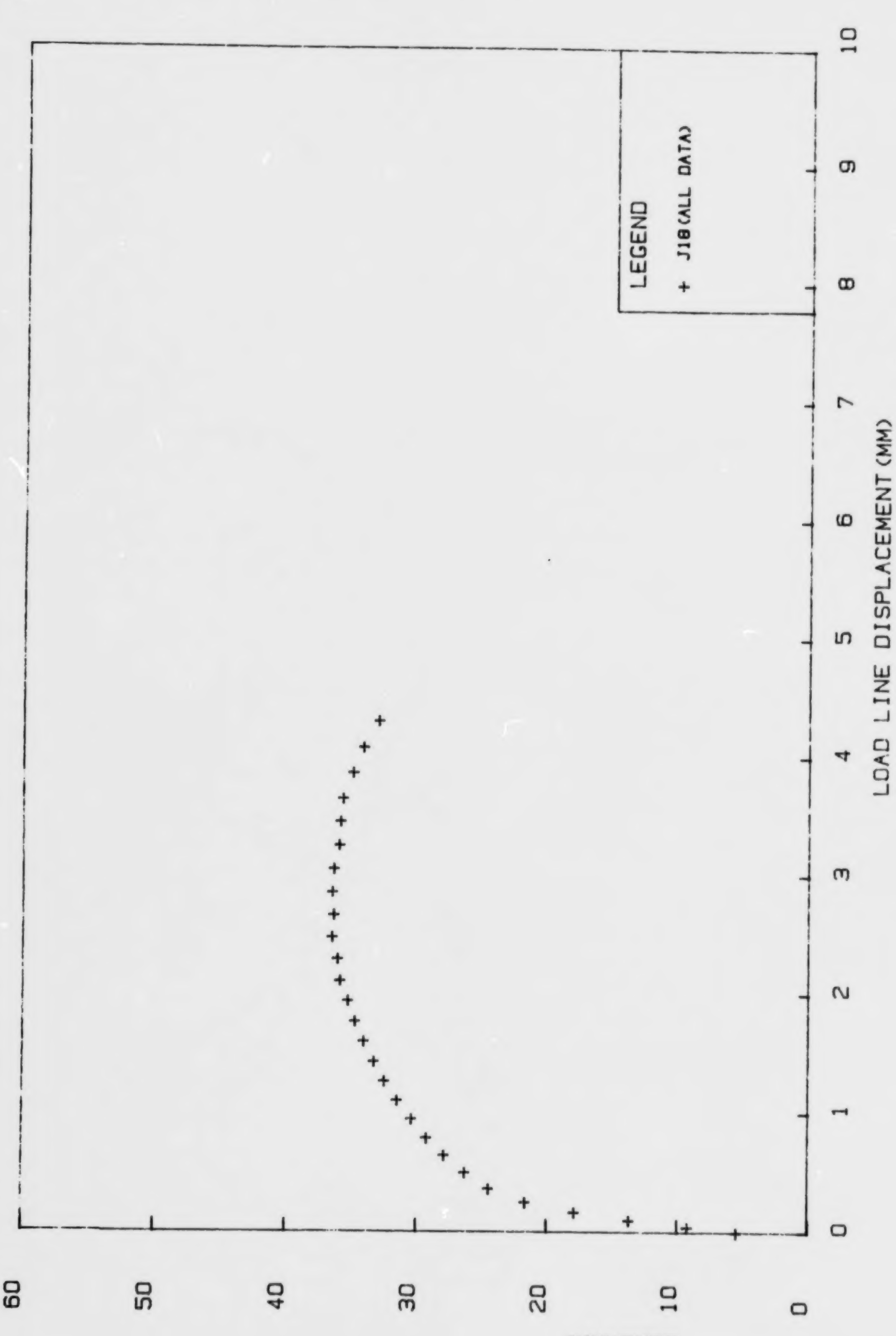
J17

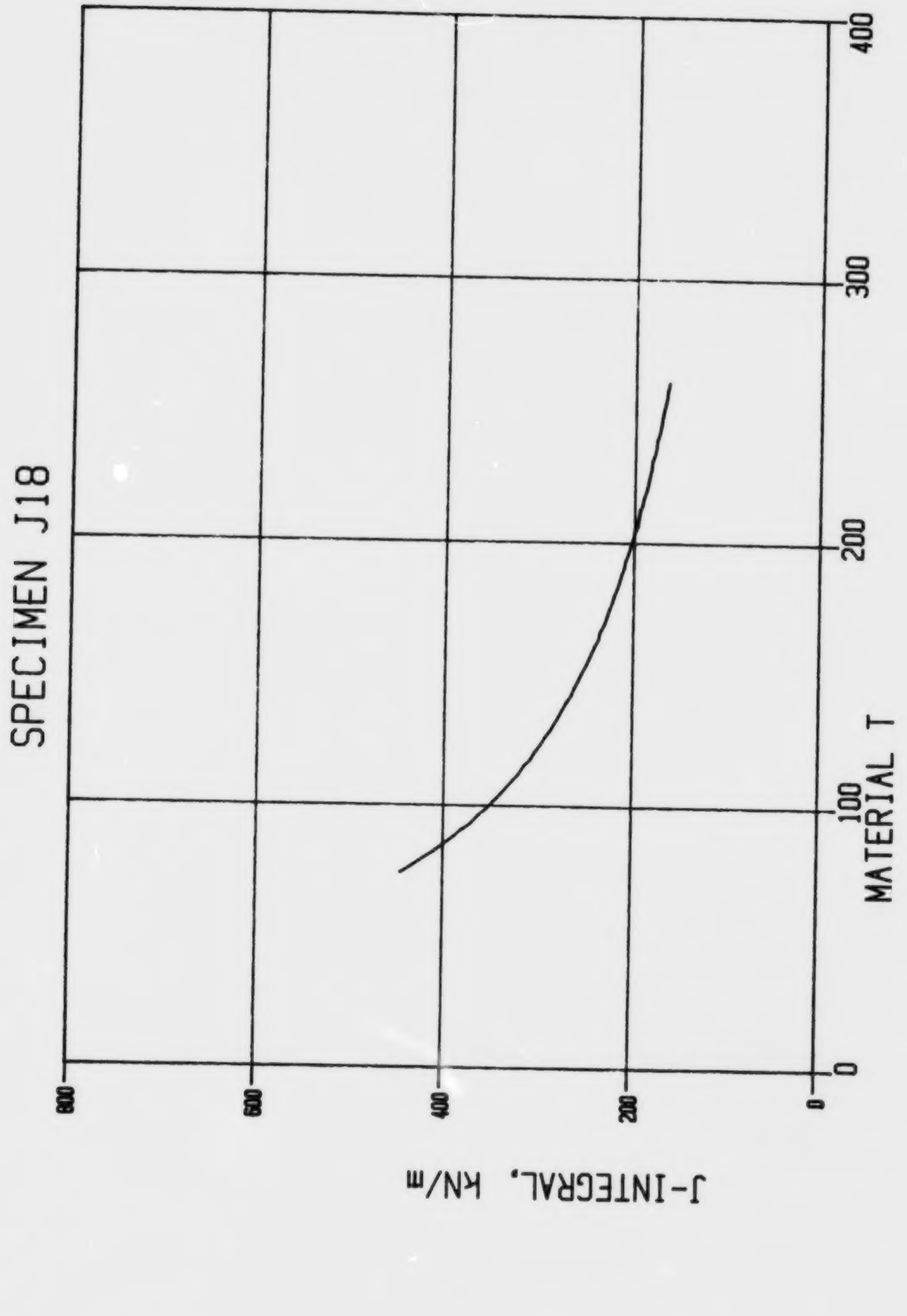
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.79	3.851	3.851	.368	.9999	1
4.04	3.855	3.856	.418	.9998	2
7.61	3.83	3.831	.169	.9998	3
13.34	3.831	3.833	.187	1	4
22.47	3.829	3.831	.172	.9998	5
35.36	3.835	3.838	.24	.9999	6
49.97	3.83	3.834	.198	.9999	7
65.98	3.825	3.83	.157	.9998	8
83.14	3.816	3.821	.072	.9998	9
100.06	3.827	3.834	.197	1	10
118.13	3.838	3.845	.314	.9996	11
137.71	3.844	3.853	.386	.9999	12
157.79	3.852	3.861	.472	.9999	13
177.78	3.866	3.877	.625	.9999	14
199.84	3.869	3.88	.665	.9998	15
220.7	3.884	3.896	.82	.9999	16
242.11	3.899	3.912	.979	.9998	17
262.95	3.925	3.939	1.25	.9999	18
286.39	3.945	3.96	1.457	.9999	19
306.78	3.979	3.995	1.807	.9997	20
328.91	4.002	4.019	2.05	.9999	21
351.49	4.029	4.046	2.324	.9997	22
372.46	4.063	4.081	2.668	.9999	23
395.41	4.088	4.107	2.935	.9999	24
414.91	4.127	4.147	3.329	.9998	25
434.77	4.167	4.188	3.739	.9999	26
453.7	4.212	4.233	4.193	1	27
469.82	4.26	4.281	4.673	.9995	28

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J17
1	5.615	0	
2	9.338	.045	
3	13.855	.103	
4	18.127	.166	
5	21.973	.249	
6	24.841	.36	
7	26.672	.503	
8	28.198	.652	
9	29.541	.807	
10	30.701	.964	
11	31.799	1.123	
12	32.715	1.287	
13	33.569	1.456	
14	34.241	1.627	
15	34.851	1.799	
16	35.278	1.976	
17	35.828	2.152	
18	36.316	2.33	
19	36.438	2.515	
20	36.438	2.711	
21	36.194	2.904	
22	36.255	3.097	
23	36.011	3.298	
24	35.706	3.501	
25	35.095	3.708	
26	34.607	3.917	
27	33.875	4.136	
28	32.776	4.363	
29	31.921	4.583	

	J(KN/M)	T	W	J17
1	127.92	373.35	52.95	
2	147.75	319.67	39.11	
3	167.78	179.67	19.24	
4	188.81	774.23	73.56	
5	210.27	184.61	15.65	
6	231.41	185.2	14.17	
7	252.53	105.5	7.32	
8	274.67	156.44	9.89	
9	296.58	79.91	4.61	
10	317.84	125.47	6.68	
11	340.2	113.38	5.58	
12	361.97	83.77	3.81	
13	383.94	118.2	5.01	
14	405.16	67.97	2.68	
15	424.84	66.72	2.47	
16	444.23	57.27	1.98	
17	461.76	46.22	1.5	


SPECIMEN J18(250C)
SLOPE 106
INTERCEPT 137
J1C 160
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J18(ALL DATA)


SPECIMEN J18
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
      DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J18
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            220.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          508.5
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             3.049
 PERCENT SIDE GROOVE                                  19.35
 SPECIMEN WIDTH W(CM)                                 6.344
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
 EFFECTIVE MODULUS(Pa)                                2.02821927E+11

                FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             22.14
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.83

                CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.934
 INITIAL A/W                                          .604
 AVERAGE CRACK EXTENSION 9PT(CM)                      .446
 DELTA A(CM) COMPLIANCE                               .425
 MAX DEVIATION OF SINGLE MEASUREMENT %                .91

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     14
 LAST POINT                      21
 JIC(KN/M)                       160
 CORRELATION COEFF               .98
 SLOPE M(MPa)                    106
 INTERCEPT B (KN/M)              137

                VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      448.28
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    380.91
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.514
 25*JQ/EF.Y.(CM)                                      1.097

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        14
 LAST DATA POINT USED       28
 CONSTANT(C1)               250.2
 EXPONENT(C2)               .4432
```

J18(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
18.57	1.72	0	1.71	1.71	1.81	3.835	1
27.65	3.81	.07	3.88	3.88	4.1	3.84	2
36.11	6.49	1.02	7.51	7.51	7.9	3.838	3
43.91	9.6	3.48	13.08	13.09	13.65	3.844	4
49.42	12.16	10.12	22.28	22.27	23.02	3.838	5
52.94	13.95	20.72	34.68	34.64	35.54	3.833	6
56.23	15.74	32.72	48.46	48.45	49.42	3.835	7
59.26	17.49	45.7	63.18	63.33	64.22	3.844	8
61.69	18.95	60.92	79.86	80.06	80.98	3.846	9
63.65	20.17	77.43	97.6	97.58	98.82	3.84	10
65.93	21.64	93.91	115.56	115.83	116.83	3.847	11
67.75	22.85	111.77	134.62	135.13	135.95	3.852	12
69.74	24.22	130.36	154.57	155.59	155.94	3.86	13
71.64	25.56	148.68	174.24	176.04	175.63	3.872	14
73.58	26.96	167.49	194.45	197.6	195.83	3.889	15
75.55	28.42	186.55	214.97	219.38	216.37	3.904	16
76.54	29.17	208.43	237.6	243.22	238.98	3.916	17
78.4	30.6	228.68	259.29	267	260.65	3.935	18
79.71	31.64	248.7	280.34	291.75	281.6	3.965	19
81.32	32.92	269.39	302.31	317.07	303.51	3.99	20
82.25	33.68	291.93	325.61	343.56	326.72	4.012	21
83.67	34.86	310.33	345.18	369.93	346.15	4.054	22
84.07	35.19	335.7	370.89	397.25	371.81	4.063	23
85.33	36.25	355.65	391.9	423.6	392.73	4.092	24
85.37	36.28	378.4	414.68	452.86	415.3	4.124	25
86.19	36.98	395.94	432.92	480.82	433.37	4.169	26
86.06	36.87	415.11	451.99	510.16	452.18	4.214	27
87.42	38.05	430.92	468.97	537.07	469.05	4.255	28

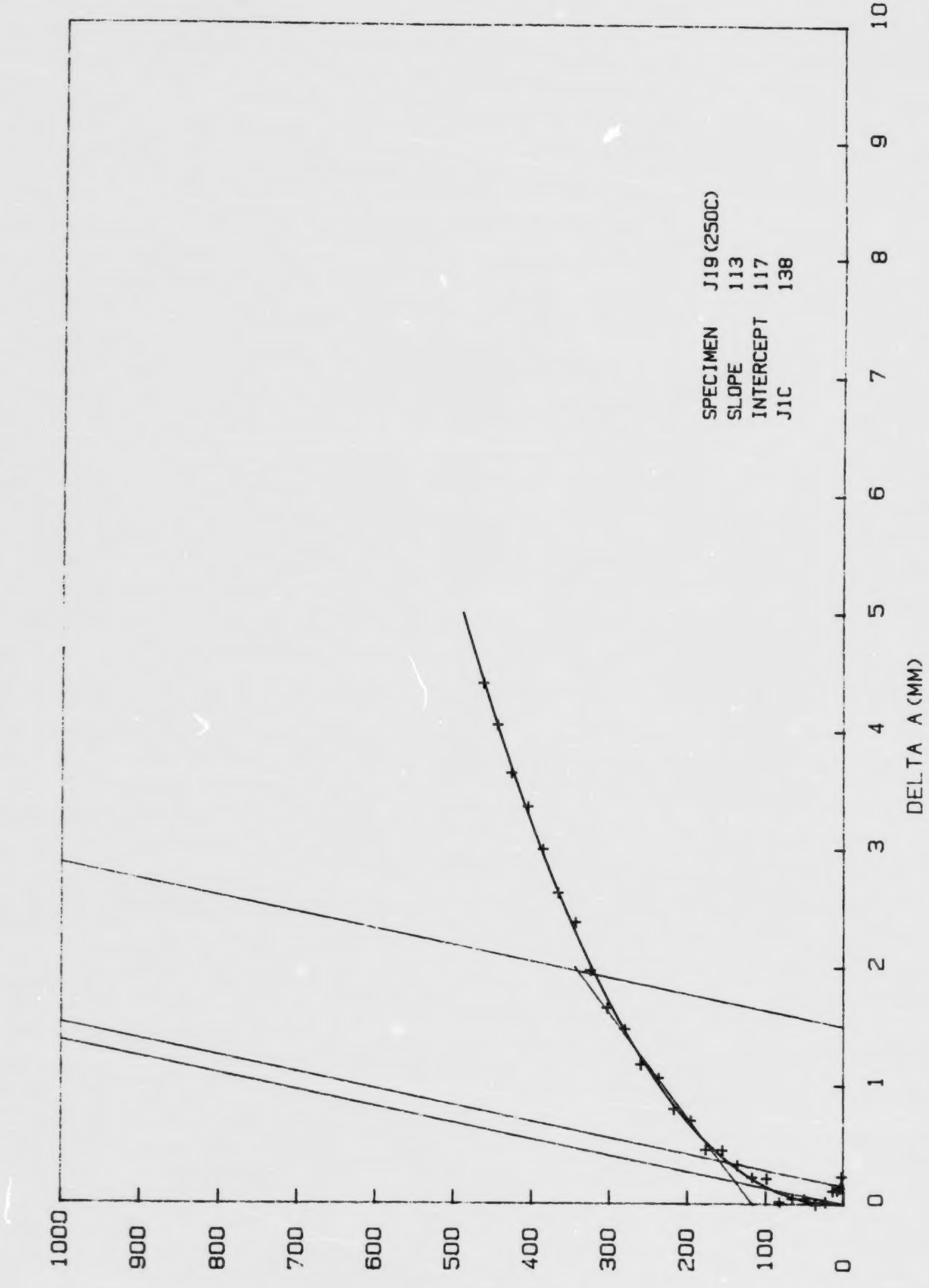
H(M)	D(M)	POISSON'S RATIO
.02382	2.54E-03	.3

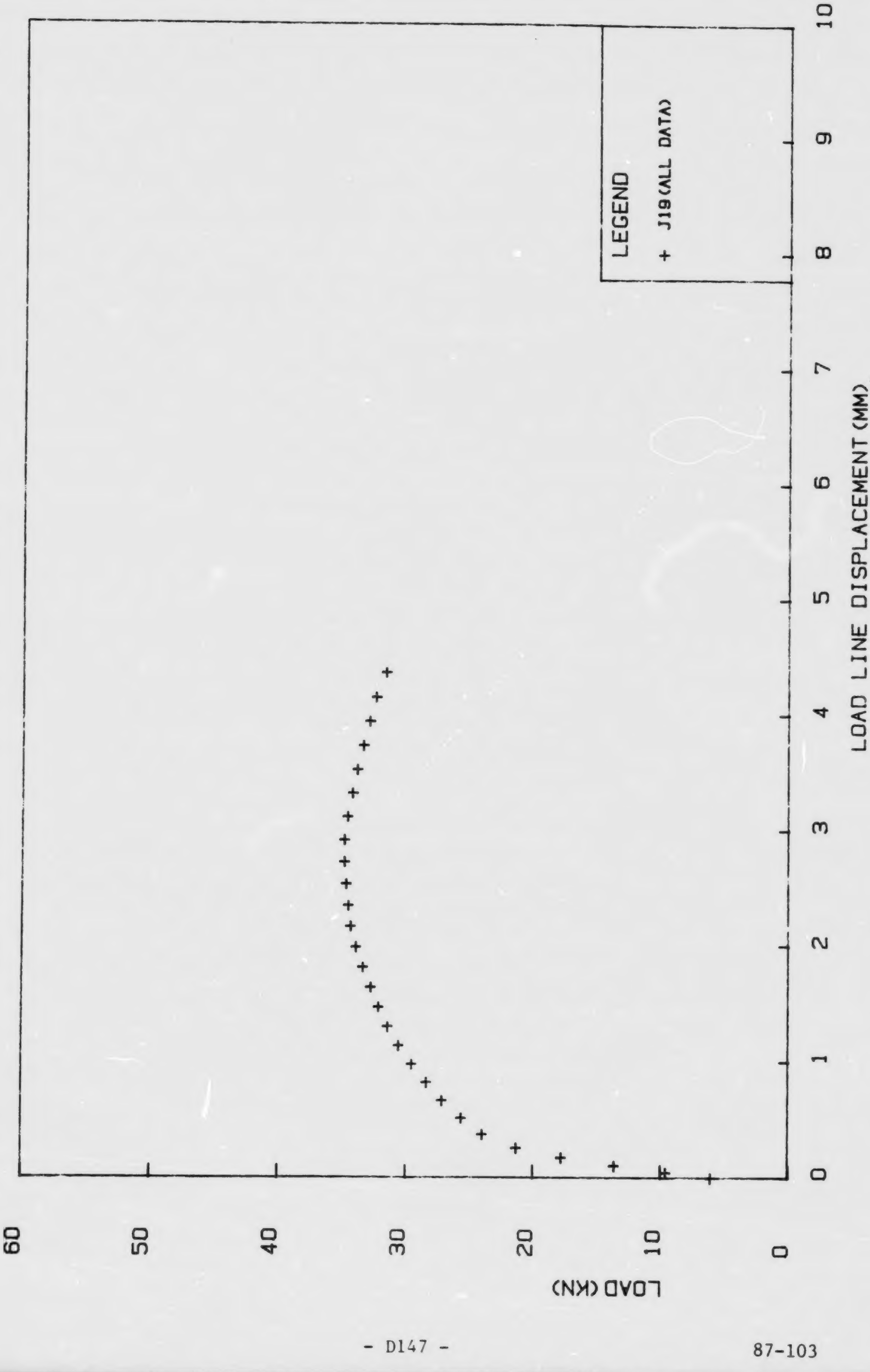
J18

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.71	3.834	3.835	.045	.9995	1
3.88	3.84	3.84	.104	.9999	2
7.51	3.837	3.838	.081	.9999	3
13.08	3.843	3.844	.139	.9998	4
22.28	3.836	3.838	.08	.9998	5
34.68	3.83	3.833	.028	1	6
48.46	3.832	3.835	.054	.9998	7
63.18	3.84	3.844	.143	.9999	8
79.86	3.841	3.846	.163	.9999	9
97.6	3.833	3.84	.096	.9997	10
115.56	3.84	3.847	.169	.9999	11
134.62	3.844	3.852	.217	.9998	12
154.57	3.851	3.86	.304	.9999	13
174.24	3.862	3.872	.42	.9999	14
194.45	3.878	3.889	.593	.9999	15
214.97	3.892	3.904	.736	.9999	16
237.6	3.903	3.916	.858	.9997	17
259.29	3.921	3.935	1.047	.9999	18
280.34	3.95	3.965	1.349	.9999	19
302.31	3.974	3.99	1.598	.9997	20
325.61	3.995	4.012	1.816	.9999	21
345.18	4.037	4.054	2.24	.9999	22
370.89	4.045	4.063	2.333	.9999	23
391.9	4.073	4.092	2.619	.9999	24
414.68	4.104	4.124	2.942	.9999	25
432.92	4.149	4.169	3.392	.9998	26
451.99	4.193	4.214	3.84	.9998	27
468.97	4.233	4.255	4.245	.9999	28

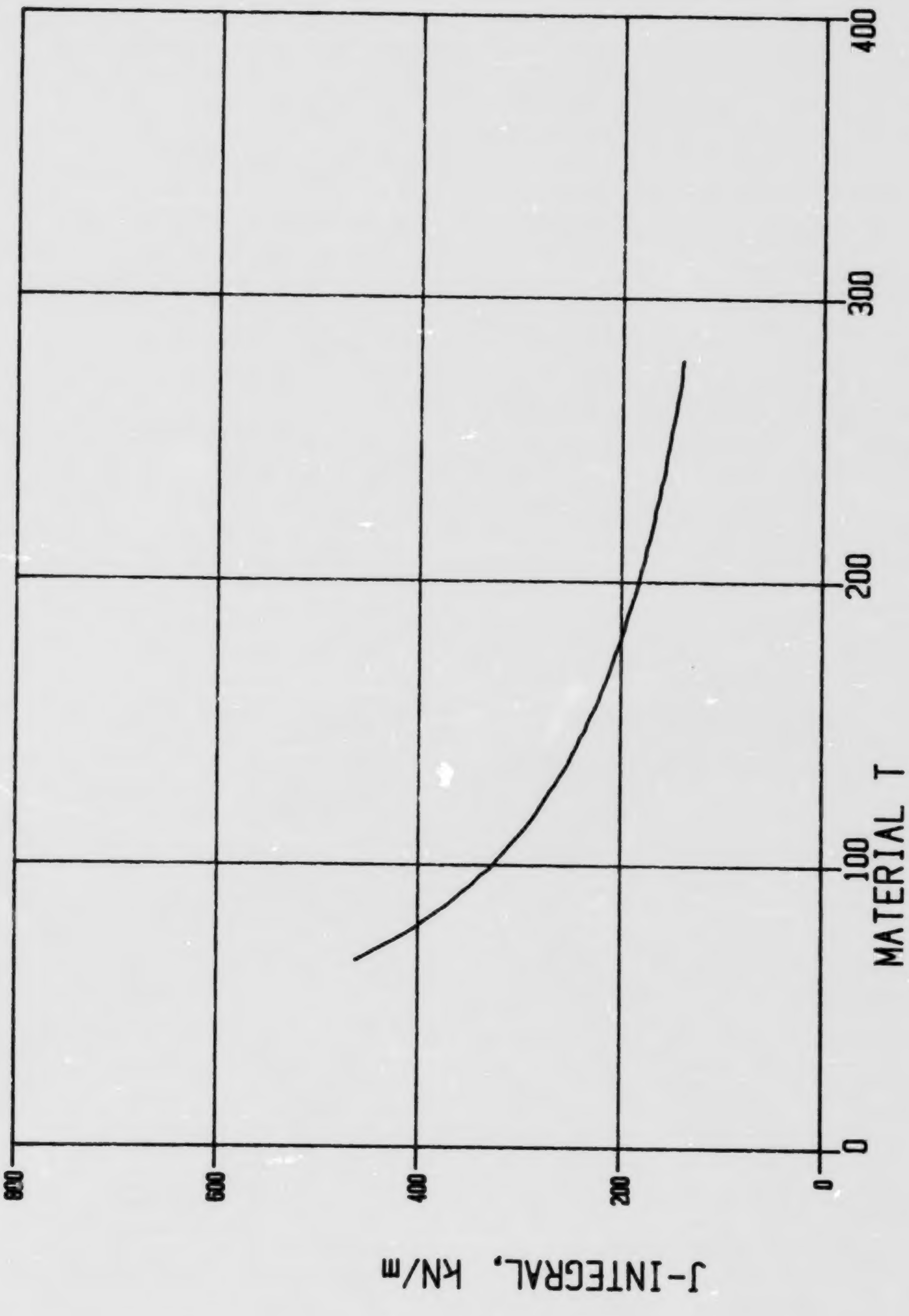
	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J18
1	5.432	0	
2	9.216	.045	
3	13.672	.101	
4	17.883	.168	
5	21.667	.25	
6	24.475	.363	
7	26.306	.499	
8	27.893	.643	
9	29.236	.791	
10	30.396	.948	
11	31.494	1.106	
12	32.471	1.267	
13	33.264	1.432	
14	34.058	1.603	
15	34.729	1.77	
16	35.278	1.943	
17	35.889	2.114	
18	36.072	2.297	
19	36.499	2.479	
20	36.377	2.668	
21	36.499	2.859	
22	36.377	3.055	
23	35.95	3.256	
24	35.889	3.453	
25	35.706	3.649	
26	34.912	3.866	
27	34.119	4.08	
28	32.959	4.305	
29	32.471	4.514	

	J(KN/M)	T	W	J18
1	164.41	232.35	25.41	
2	184.34	160.94	15.59	
3	204.71	197.26	17.1	
4	226.28	254.52	19.86	
5	248.44	157.95	11.14	
6	269.81	95.69	6.14	
7	291.33	121.47	7.14	
8	313.96	146.73	7.93	
9	335.4	63.52	3.15	
10	358.04	378.85	17.55	
11	381.4	101.21	4.35	
12	403.29	97.06	3.89	
13	423.8	55.7	2.08	
14	442.46	58.52	2.05	
15	460.48	57.56	1.9	


SPECIMEN J19(250C)
SLOPE 113
INTERCEPT 117
J1C 138
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J18(ALL DATA)
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LOAD (KN)
0
10
20
30
40
50
60

SPECIMEN J19



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      DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

   SPECIMEN NUMBER                                       J19
   MATERIAL TYPE                                         A106B
   MATERIAL CONDITION                                    PARENT
   TEST TEMPERATURE(DEG C)                               250
   MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             220.7
   MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           508.5
   CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
   SPECIMEN THICKNESS B(CM)                              3.049
   PERCENT SIDE GROOVE                                   19.481
   SPECIMEN WIDTH W(CM)                                  6.345
   YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
   EFFECTIVE MODULUS(Pa)                                 1.9658039E+11

                FATIGUE PRE-CRACKING DATA

   MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 12.5
   MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              22.69
   INITIAL CRACK LENGTH-COMPLIANCE(CM)                   3.87

                CRACK LENGTH MEASUREMENT

   AVERAGE FATIGUE LENGTH 9PT(CM)                        3.959
   INITIAL A/W                                           .61
   AVERAGE CRACK EXTENSION 9PT(CM)                       .437
   DELTA A(CM) COMPLIANCE                                .44
   MAX DEVIATION OF SINGLE MEASUREMENT %                 .96

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

   FIRST POINT                     13
   LAST POINT                      20
   JIC(KN/M)                       138
   CORRELATION COEFF               .98
   SLOPE M(MPa)                    113
   INTERCEPT B (KN/M)              117

                VALIDITY(JIC)

   BN>25JIC/EFFECTIVE YIELD        YES
   LIGAMENT>25JIC/EFFECTIVE YIELD  YES
   DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

   CRACK EXTENSION VALIDITY                              YES
   CRACK SIZE DA<0.15*DELTA A                            YES
   J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       447.55
   OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     370.97
   DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.475
   25*JQ/EF.Y.(CM)                                       .946

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

   1st DATA POINT USED        13
   LAST DATA POINT USED       28
   CONSTANT(C1)               235.48
   EXPONENT(C2)               .4554
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           J19(250C)

K           J-ELASTIC        J-PLASTIC      JEL+JPL        J(M)        J(TO.AREA)   CR.  LN
(MPaRTM)    (KN/M)            (KN/M)         (KN/M)       (KN/M)          (KN/M)         (CM)

20.05       2                 .03            2.03          2.03         2.11      3.894  1
28.3        3.99              .41            4.4           4.4          4.62      3.884  2
36.89       6.77              1.36           8.14          8.14         8.54      3.882  3
44.22       9.74              4.21           13.95         13.95        14.53     3.881  4
49.5        12.2              11.25          23.45         23.43        24.22     3.872  5
52.82       13.89             22.13          36.02         35.99        36.9      3.87   6
56.14       15.69             34.48          50.17         50.19        51.14     3.875  7
58.67       17.14             48.7           65.84         65.86        66.9      3.875  8
60.97       18.51             64.04          82.55         82.51        83.71     3.872  9
63.91       20.34             78.45          98.79         99.41        99.98     3.892  10
65.74       21.52             95.68          117.2         117.86       118.46    3.893  11
67.72       22.83             113.18         136.01        137.19       137.3     3.903  12
69.56       24.09             131.24         155.33        157.26       156.63    3.916  13
70.88       25.01             151.38         176.39        178.34       177.75    3.916  14
73.2        26.68             168.81         195.49        199.42       196.83    3.941  15
74.6        27.7              189.3          217           221.81       218.35    3.95   16
76.3        28.99             207.78         236.77        244.23       238.06    3.976  17
77.3        29.75             229.99         259.74        268.49       261.01    3.988  18
79.15       31.19             248.94         280.13        292.61       281.33    4.018  19
80.12       31.96             270.83         302.79        317.72       303.93    4.036  20
81.32       32.92             291.21         324.14        343.82       325.15    4.067  21
82.64       34                309.54         343.55        369.84       344.4     4.108  22
83.22       34.48             331.69         366.16        396.82       366.89    4.133  23
84.23       35.32             350.49         385.82        423.46       386.39    4.17   24
85.24       36.18             369.27         405.44        450.44       405.87    4.206  25
85.78       36.63             390.1          426.73        477.87       427       4.234  26
86.31       37.08             407.78         444.86        505.42       444.95    4.275  27
87.15       37.82             425.19         463.01        532.22       462.97    4.31   28

H(M)             D(M)             POISSON'S RATIO
.02383           2.54E-03         .3
```
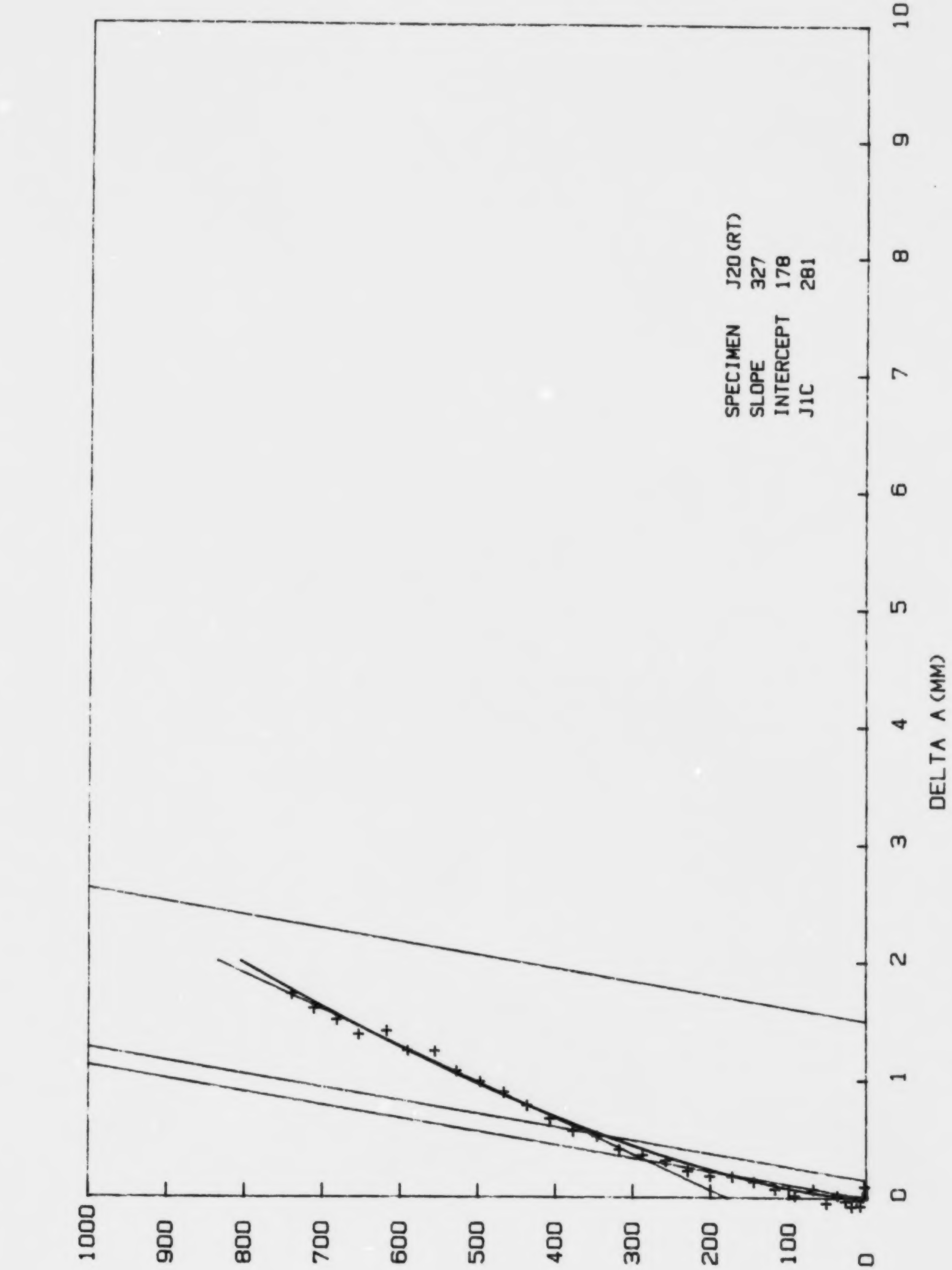

J19

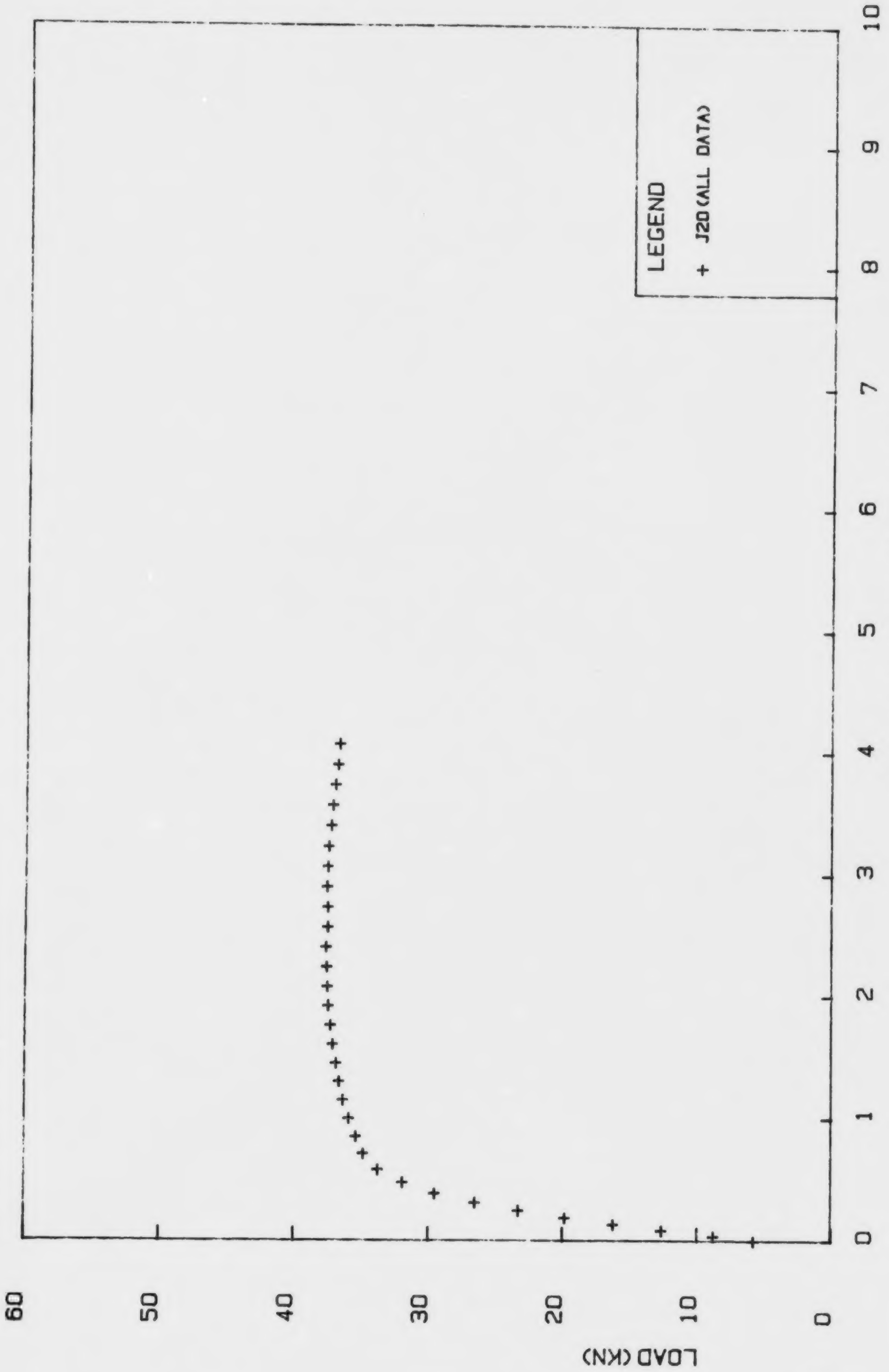
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.03	3.893	3.894	.236	.9999	1
4.4	3.883	3.884	.138	1	2
8.14	3.881	3.882	.12	1	3
13.95	3.88	3.881	.114	.9998	4
23.45	3.87	3.872	.021	.9999	5
36.02	3.867	3.87	-3E-03	.9999	6
50.17	3.871	3.875	.045	.9997	7
65.84	3.87	3.875	.047	.9999	8
82.55	3.867	3.872	.021	.9999	9
98.79	3.886	3.892	.22	.9999	10
117.2	3.886	3.893	.23	.9999	11
136.01	3.895	3.903	.332	.9999	12
155.33	3.907	3.916	.457	.9999	13
176.39	3.906	3.916	.461	.9998	14
195.49	3.93	3.941	.706	.9999	15
217	3.939	3.95	.802	.9998	16
236.77	3.964	3.976	1.064	.9998	17
259.74	3.974	3.988	1.179	1	18
280.13	4.003	4.018	1.477	.9998	19
302.79	4.02	4.036	1.656	.9999	20
324.14	4.051	4.067	1.973	.9998	21
343.55	4.091	4.108	2.38	.9999	22
366.16	4.115	4.133	2.628	.9996	23
385.82	4.151	4.17	2.997	.9999	24
405.44	4.187	4.206	3.359	.9999	25
426.73	4.214	4.234	3.642	.9999	26
444.86	4.254	4.275	4.049	.9998	27
463.01	4.289	4.31	4.4	.9998	28

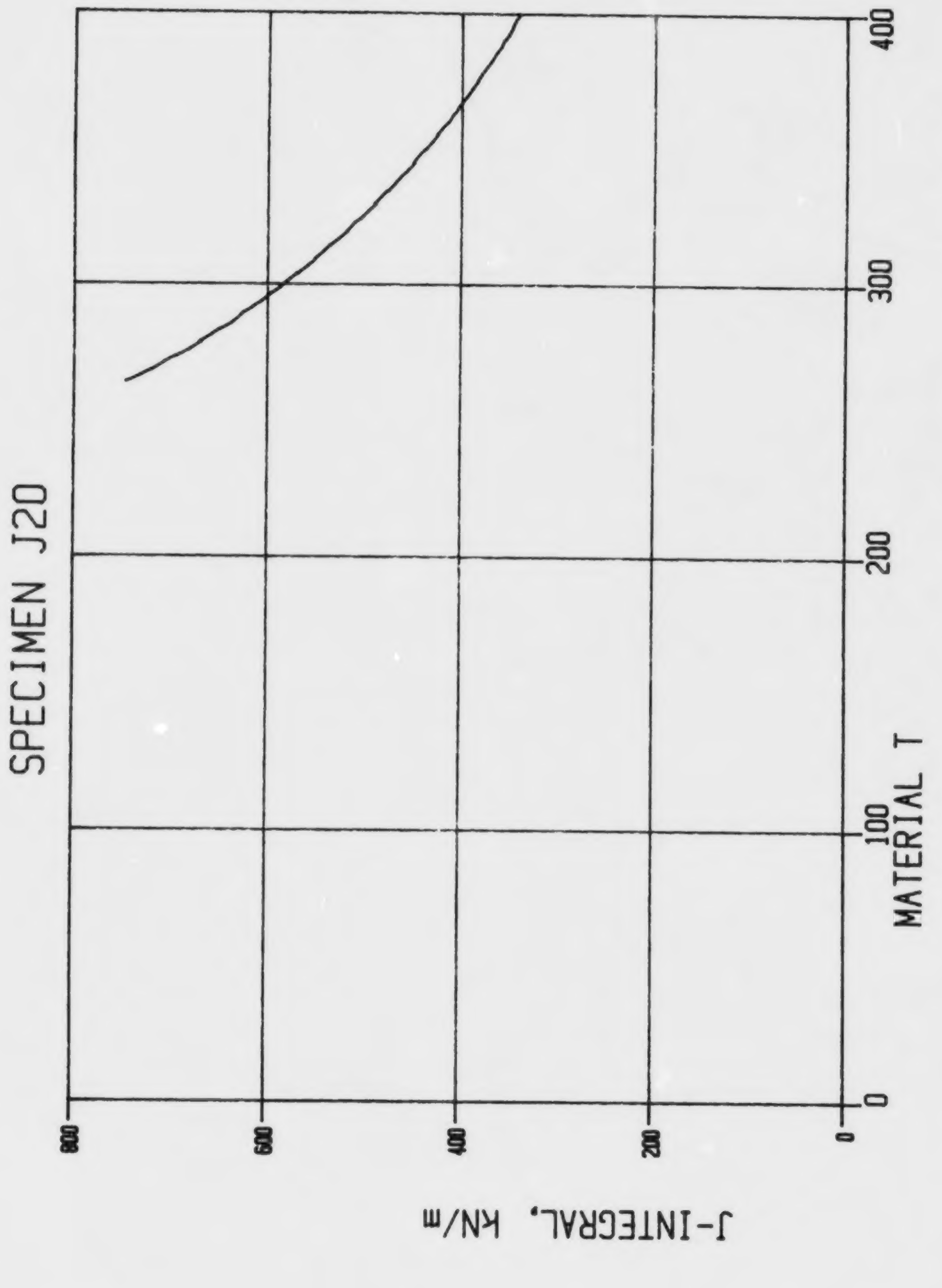
```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J19
 1          6.042          0
 2          9.583          .046
 3         13.611          .105
 4         17.761          .173
 5         21.301          .258
 6         23.987          .374
 7         25.635          .514
 8         27.161          .664
 9         28.381          .82
 10        29.541          .979
 11        30.579         1.138
 12        31.433         1.301
 13        32.166         1.47
 14        32.776         1.641
 15        33.386         1.814
 16        33.936         1.989
 17        34.363         2.167
 18        34.546         2.346
 19        34.729         2.534
 20        34.851         2.723
 21        34.851         2.915
 22        34.607         3.116
 23        34.18          3.319
 24        33.813         3.524
 25        33.325         3.73
 26        32.837         3.939
 27        32.349         4.149
 28        31.555         4.365
 29        31.006         4.575
```

	J(KN/M)	T	W	J19
1	145.67	213.29	25.87	
2	165.86	7499.26	798.74	
3	185.94	107.04	10.07	
4	206.24	307.12	25.94	
5	226.89	103.85	7.88	
6	248.25	275.86	19.05	
7	269.94	94.02	5.9	
8	291.46	174.08	10.03	
9	313.46	92.52	4.89	
10	333.84	65.65	3.2	
11	354.85	125.2	5.68	
12	375.99	73.29	3.08	
13	395.63	74.55	2.93	
14	416.09	103.35	3.81	
15	435.79	61.31	2.12	
16	453.94	70.9	2.31	



SPECIMEN J2D(RT)
SLOPE 327
INTERCEPT 178
J1C 281
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J20 (ALL DATA)



SPECIMEN J20
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

SPECIMEN NUMBER                                        J20
MATERIAL TYPE                                          A106B
MATERIAL CONDITION                                     WELD(PN107)
TEST TEMPERATURE(DEG C)                                20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)              347.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)            547.2
CRACK PLANE ORIENTATION (PER ASTM E399)                L-C
SPECIMEN THICKNESS B(CM)                               2.541
PERCENT SIDE GROOVE                                    20.11
SPECIMEN WIDTH W(CM)                                   5.09500001
YOUNGS MODULUS AT TEST TEMP(Pa)                        1.92346E+11
EFFECTIVE MODULUS(Pa)                                  2.19795441E+11

                FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                  10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM               22.15
INITIAL CRACK LENGTH-COMPLIANCE(CM)                    2.985

                CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                         3.103
INITIAL A/W                                            .586
AVERAGE CRACK EXTENSION 9PT(CM)                        .189
DELTA A(CM) COMPLIANCE                                 .172
MAX DEVIATION OF SINGLE MEASUREMENT %                  3.76

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                     21
LAST POINT                      32
JIC(KN/M)                       281
CORRELATION COEFF               .98
SLOPE M(MPa)                    327
INTERCEPT B (KN/M)              178

                VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD        YES
LIGAMENT>25JIC/EFFECTIVE YIELD  YES
DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                               YES
CRACK SIZE DA<0.15*DELTA A                             YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                        454.16
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                      433.56
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                       2.11
25*JQ/EF.Y.(CM)                                        1.57

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED        21
LAST DATA POINT USED       32
CONSTANT(C1)               511.49
EXPONENT(C2)               .654
```

J20(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.34	2.36	.02	2.38	2.38	2.5	2.995	1
31.91	4.82	.02	4.84	4.84	5.11	2.987	2
40.76	7.86	.57	8.43	8.43	8.89	2.979	3
49.97	11.82	1.24	13.06	13.06	13.73	2.983	4
58.51	16.2	3.33	19.53	19.53	20.47	2.978	5
66.84	21.14	6.36	27.49	27.5	28.72	2.982	6
74.67	26.38	11.48	37.86	37.89	39.38	2.988	7
80.27	30.48	21.73	52.21	52.19	53.99	2.981	8
85.63	34.69	34.39	69.08	69.21	71.06	2.993	9
88.04	36.67	55.85	92.52	92.54	94.65	2.987	10
89.8	38.15	79.43	117.58	117.79	119.76	2.993	11
91.62	39.72	104.81	144.53	145.05	146.76	2.999	12
93	40.92	131.14	172.06	172.86	174.34	3.003	13
93.81	41.63	159.17	200.8	201.63	203.12	3.003	14
94.73	42.45	186.78	229.23	230.47	231.57	3.008	15
95.98	43.58	213.75	257.33	259.6	259.68	3.016	16
96.8	44.33	242.88	287.21	290.12	289.57	3.021	17
97.61	45.08	272.19	317.27	320.88	319.63	3.026	18
98.61	46	299.93	345.94	351.49	348.28	3.037	19
99.1	46.46	330.51	376.97	383.35	379.31	3.041	20
100.05	47.36	359.6	406.96	415.52	409.28	3.052	21
100.59	47.87	388.52	436.4	447.55	438.67	3.063	22
101.45	48.69	417.59	466.28	480.16	468.52	3.074	23
102.35	49.56	447.12	496.68	513.03	498.9	3.083	24
102.91	50.1	477.25	527.35	546.31	529.54	3.092	25
104.1	51.27	503.86	555.13	579.24	557.28	3.109	26
103.61	50.79	539.23	590.02	614.23	592.13	3.109	27
104.65	51.82	565.52	617.33	647.42	619.4	3.126	28
103.88	51.05	602.35	653.4	682.33	655.45	3.123	29
104.4	51.56	629.77	681.33	715.17	683.33	3.135	30
104.86	52.02	659.08	711.11	748.95	713.06	3.145	31
105.4	52.55	687.27	739.83	783.08	741.72	3.157	32

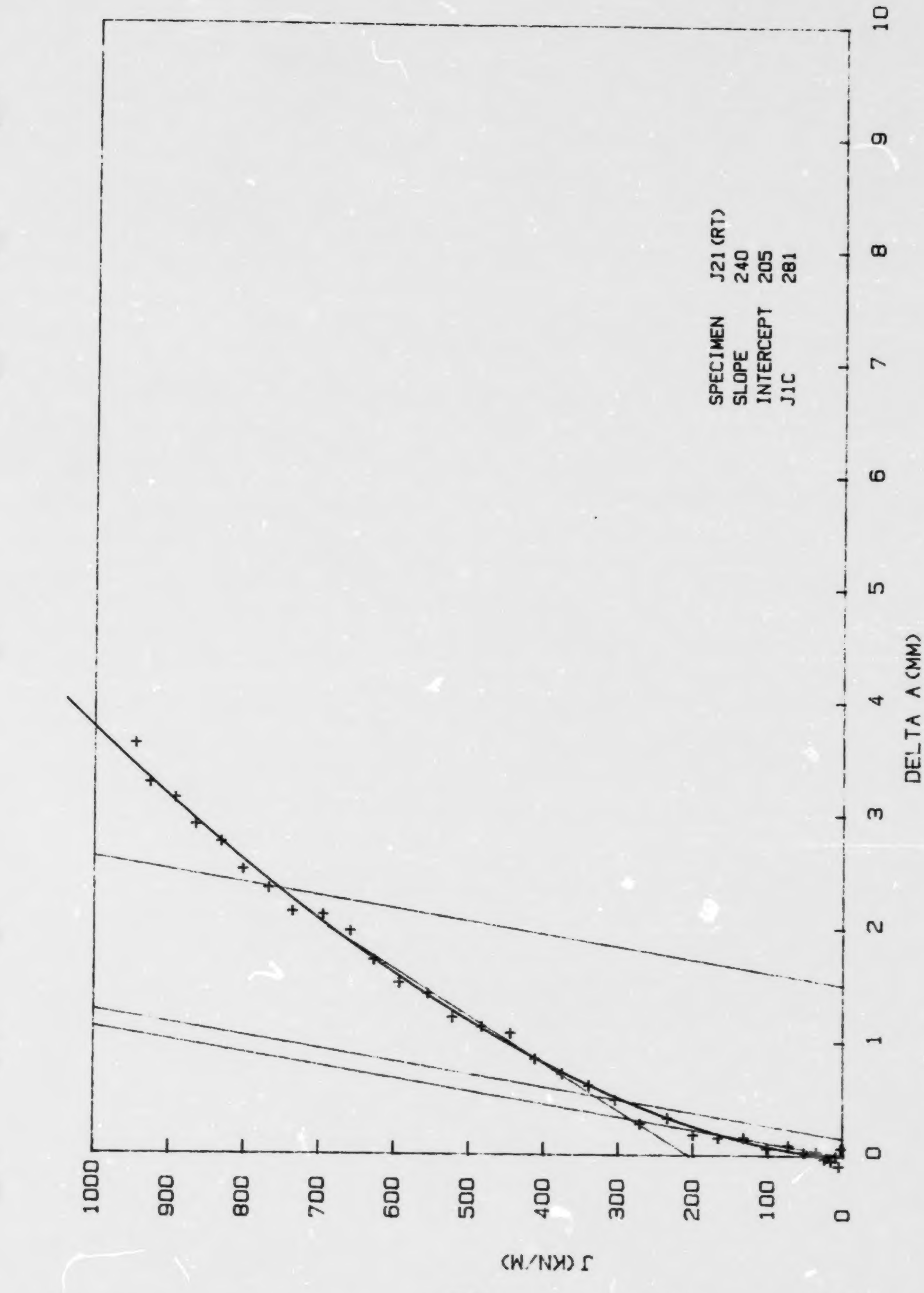
H(M)	D(M)	POISSON'S RATIO
.01902	2.54E-03	.3

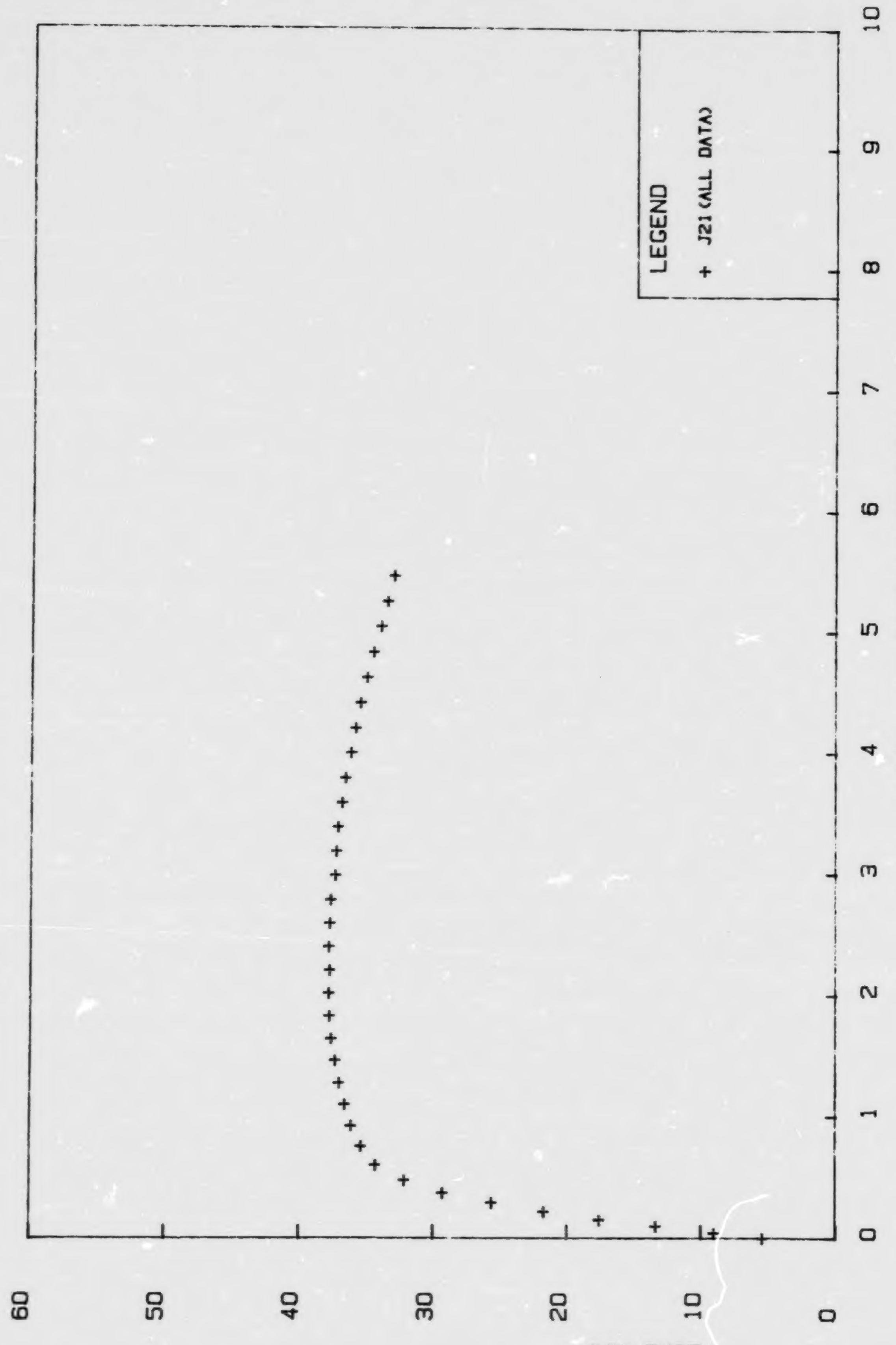
J20

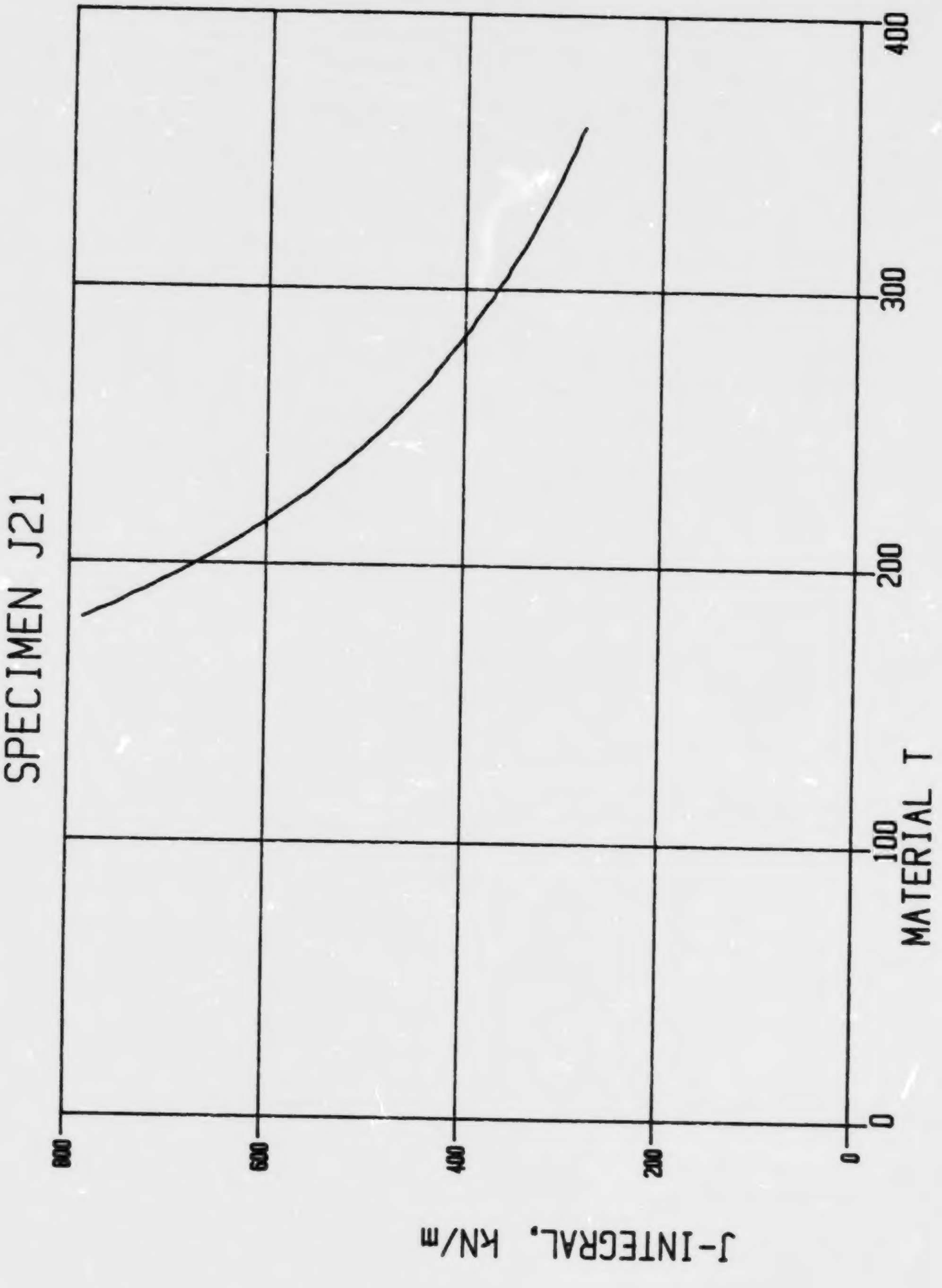
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.38	2.995	2.995	.099	.9994	1
4.84	2.986	2.987	.015	.9999	2
8.43	2.978	2.979	-.064	.9998	3
13.06	2.982	2.983	-.017	.9999	4
19.53	2.977	2.978	-.07	.9998	5
27.49	2.98	2.982	-.027	.9997	6
37.86	2.985	2.988	.027	.9999	7
52.21	2.978	2.981	-.043	.9998	8
69.08	2.989	2.993	.076	.9999	9
92.52	2.983	2.987	.019	.9999	10
117.58	2.987	2.993	.076	.9998	11
144.53	2.993	2.999	.138	.9998	12
172.06	2.996	3.003	.18	.9998	13
200.8	2.996	3.003	.184	.9999	14
229.23	2.999	3.008	.226	.9999	15
257.33	3.006	3.016	.312	.9999	16
287.21	3.01	3.021	.361	.9998	17
317.27	3.014	3.026	.406	.9998	18
345.94	3.024	3.037	.519	.9997	19
376.97	3.028	3.041	.563	.9998	20
406.96	3.037	3.052	.666	.9997	21
436.4	3.047	3.063	.779	.9998	22
466.28	3.057	3.074	.888	.9998	23
496.68	3.066	3.083	.98	1	24
527.35	3.074	3.092	1.071	.9998	25
555.13	3.089	3.109	1.237	.9999	26
590.02	3.089	3.109	1.24	.9998	27
617.33	3.104	3.126	1.407	.9999	28
653.4	3.1	3.123	1.376	.9998	29
681.33	3.112	3.135	1.5	.9998	30
711.11	3.12	3.145	1.597	.9999	31
739.83	3.132	3.157	1.721	.9998	32

```
            LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J20
 1           5.737         0
 2           8.789          .039
 3          12.634          .085
 4          16.235          .135
 5          19.836          .188
 6          23.315          .248
 7          26.55           .313
 8          29.541          .387
 9          31.921          .477
 10         33.752          .581
 11         34.851          .712
 12         35.4            .852
 13         35.95          1.001
 14         36.377         1.15
 15         36.682         1.301
 16         36.926         1.453
 17         37.17          1.605
 18         37.354         1.763
 19         37.537         1.92
 20         37.598         2.078
 21         37.659         2.239
 22         37.72          2.402
 23         37.598         2.565
 24         37.598         2.729
 25         37.659         2.894
 26         37.598         3.06
 27         37.537         3.226
 28         37.354         3.397
 29         37.231         3.564
 30         37.048         3.734
 31         36.865         3.899
 32         36.743         4.067
 33         36.56          4.238
```

	J(KN/M)	T	W	J20
1	272.27	594.44	47.13	
2	302.24	633.76	45.17	
3	331.6	244.53	15.8	
4	361.45	682.13	40.34	
5	391.97	277.58	15.06	
6	421.68	251.21	12.6	
7	451.34	262.02	12.21	
8	481.48	317.36	13.8	
9	512.01	326.2	13.28	
10	541.24	160.21	6.12	
11	572.57	11215.37	404.91	
12	603.67	157.3	5.34	
13	635.37	-1109.46	-35.85	
14	667.37	216.03	6.6	
15	696.22	296.66	8.65	
16	725.47	222.37	6.18	


SPECIMEN J21 (RT)
SLOPE 240
INTERCEPT 205
J1C 281
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J21 (ALL DATA)


SPECIMEN J21
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

```
     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

SPECIMEN NUMBER                                   J21
MATERIAL TYPE                                     A106B
MATERIAL CONDITION                                WELD(PN107)
TEST TEMPERATURE(DEG C)                           20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         347.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       547.2
CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
SPECIMEN THICKNESS B(CM)                          2.542
PERCENT SIDE GROOVE                               21.518
SPECIMEN WIDTH W(CM)                              5.09
YOUNGS MODULUS AT TEST TEMP(Pa)                   1.92346E+11
EFFECTIVE MODULUS(Pa)                             2.15304287E+11

                FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          21.89
INITIAL CRACK LENGTH-COMPLIANCE(CM)               2.966

                CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                    3.064
INITIAL A/W                                       .583
AVERAGE CRACK EXTENSION 9PT(CM)                   .359
DELTA A(CM) COMPLIANCE                            .362
MAX DEVIATION OF SINGLE MEASUREMENT %             4.4

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                   16
LAST POINT                    28
JIC(KN/M)                     281
CORRELATION COEFF             .99
SLOPE M(MPa)                  240
INTERCEPT B (KN/M)            205

                VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD        YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                          YES
CRACK SIZE DA<0.15*DELTA A                        YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   446.33
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 394.27
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.124
25*JQ/EF.Y.(CM)                                   1.57

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED        16
LAST DATA POINT USED       34
CONSTANT(C1)               452.45
EXPONENT(C2)               .5991
```

J21(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.84	2.47	-.02	2.44	2.44	2.58	2.973	1
33.41	5.28	.32	5.6	5.6	5.94	2.957	2
44.22	9.25	.39	9.64	9.64	10.22	2.966	3
54.49	14.05	2.1	16.15	16.15	17.05	2.962	4
64.37	19.6	5.23	24.83	24.84	26.08	2.964	5
73.9	25.84	10.04	35.88	35.9	37.51	2.97	6
81.12	31.13	21.33	52.46	52.48	54.43	2.97	7
86.89	35.72	37.46	73.18	73.28	75.41	2.976	8
89.5	37.9	63.91	101.81	101.85	104.2	2.973	9
91.99	40.03	92.55	132.58	132.99	135.04	2.982	10
93.2	41.09	125.17	166.26	166.65	168.79	2.982	11
94.47	42.22	157.77	200	200.59	202.58	2.984	12
96.3	43.88	190.36	234.24	236.28	236.79	2.999	13
96.72	44.25	226.76	271.02	272.45	273.64	2.994	14
98.57	45.96	258.12	304.08	308.49	306.63	3.015	15
99.67	47	292.4	339.4	345.85	341.9	3.028	16
100.29	47.58	327.61	375.19	383.55	377.63	3.038	17
101.45	48.69	363	411.69	422.74	414.08	3.051	18
103.07	50.26	394.57	444.83	461.12	447.12	3.073	19
103.36	50.54	432.48	483.02	500.76	485.27	3.079	20
103.01	50.2	472	522.2	542.21	524.34	3.087	21
104.56	51.72	503.59	555.32	581.76	557.37	3.108	22
104.97	52.13	541.26	593.38	622.8	595.37	3.117	23
105.81	52.97	574.04	627.01	663.63	628.86	3.138	24
107.32	54.49	603.85	658.34	704.66	660.08	3.163	25
107.3	54.47	640.58	695.05	747.07	696.64	3.177	26
106.64	53.8	682.02	735.82	789	737.32	3.18	27
107.38	54.55	713.2	767.76	830.47	769.13	3.201	28
107.36	54.54	747.54	802.07	872.65	803.27	3.217	29
108.07	55.26	775.78	831.04	914.01	832.1	3.241	30
107.74	54.91	810.46	865.37	956.38	866.24	3.256	31
108.37	55.56	837.06	892.63	996.81	893.37	3.28	32
108.07	55.26	871.38	926.64	1038.79	927.21	3.293	33
109.6	56.83	889.05	945.89	1079.29	946.42	3.328	34

H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

J21

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.44	2.973	2.973	.07	.9997	1
5.6	2.957	2.957	-.087	.9997	2
9.64	2.965	2.966	1E-03	.9999	3
16.15	2.961	2.962	-.041	1	4
24.83	2.962	2.964	-.023	.9999	5
35.88	2.968	2.97	.039	.9997	6
52.46	2.967	2.97	.035	.9997	7
73.18	2.972	2.976	.096	.9997	8
101.81	2.968	2.973	.069	.9997	9
132.58	2.977	2.982	.163	.9999	10
166.26	2.975	2.982	.158	.9997	11
200	2.977	2.984	.185	.9999	12
234.24	2.99	2.999	.332	.9997	13
271.02	2.984	2.994	.281	.9997	14
304.08	3.004	3.015	.491	.9996	15
339.4	3.015	3.028	.616	.9998	16
375.19	3.024	3.038	.719	.9999	17
411.69	3.036	3.051	.848	.9999	18
444.83	3.058	3.073	1.074	.9999	19
483.02	3.062	3.079	1.131	.9998	20
522.2	3.069	3.087	1.212	.9999	21
555.32	3.089	3.108	1.422	.9998	22
593.38	3.097	3.117	1.512	.9999	23
627.01	3.116	3.138	1.715	.9999	24
658.34	3.141	3.163	1.971	.9997	25
695.05	3.154	3.177	2.112	.9997	26
735.82	3.155	3.18	2.139	.9999	27
767.76	3.175	3.201	2.346	.9999	28
802.07	3.19	3.217	2.509	.9998	29
831.04	3.214	3.241	2.752	.9999	30
865.37	3.228	3.256	2.902	.9997	31
892.63	3.25	3.28	3.136	.9997	32
926.64	3.263	3.293	3.271	.9998	33
945.89	3.297	3.328	3.617	.9998	34

	J(KN/M)	T	W	J21
1	287.55	151.51	11.38	
2	321.74	270.5	18.05	
3	357.3	335.13	20.04	
4	393.44	271.55	14.65	
5	428.26	140.98	6.91	
6	463.92	645.18	29.11	
7	502.61	463.58	19.23	
8	538.76	151.39	5.8	
9	574.35	405	14.48	
10	610.2	159.28	5.3	
11	642.67	117.79	3.68	
12	676.69	250.14	7.36	
13	715.44	1441.09	40.05	
14	751.79	147.89	3.87	
15	784.92	202.65	5.03	
16	816.56	114.72	2.7	
17	848.21	219.74	4.95	
18	879	111.88	2.4	
19	909.63	240.78	4.95	
20	936.26	53.51	1.05	

```
           LOAD(KN)       LOAD LINE DISPLACEMENT(MM)      J21
1            5.371          0
2            9.033          .044
3           13.367          .1
4           17.578          .154
5           21.729          .22
6           25.635          .293
7           29.297          .374
8           32.166          .479
9           34.302          .601
10          35.4            .757
11          36.133          .925
12          36.621          1.101
13          37.048          1.277
14          37.354          1.462
15          37.659          1.643
16          37.781          1.829
17          37.842          2.017
18          37.781          2.205
19          37.842          2.4
20          37.781          2.593
21          37.72           2.786
22          37.354          2.988
23          37.292          3.186
24          37.17           3.386
25          36.865          3.589
26          36.621          3.794
27          36.194          4.001
28          35.889          4.204
29          35.522          4.412
30          35.034          4.622
31          34.546          4.832
32          33.997          5.044
33          33.508          5.251
34          33.02           5.464
35          32.471          5.679
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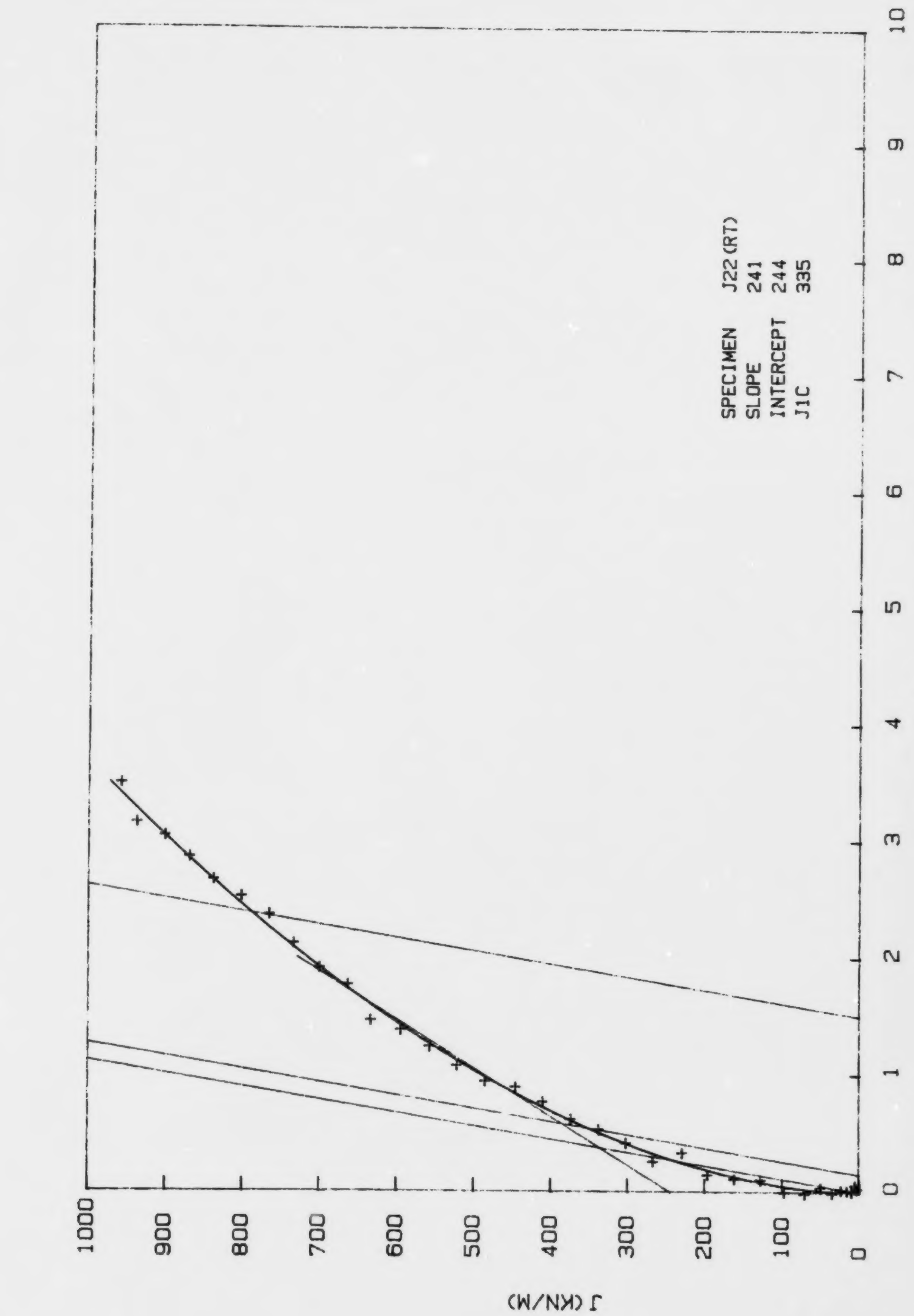
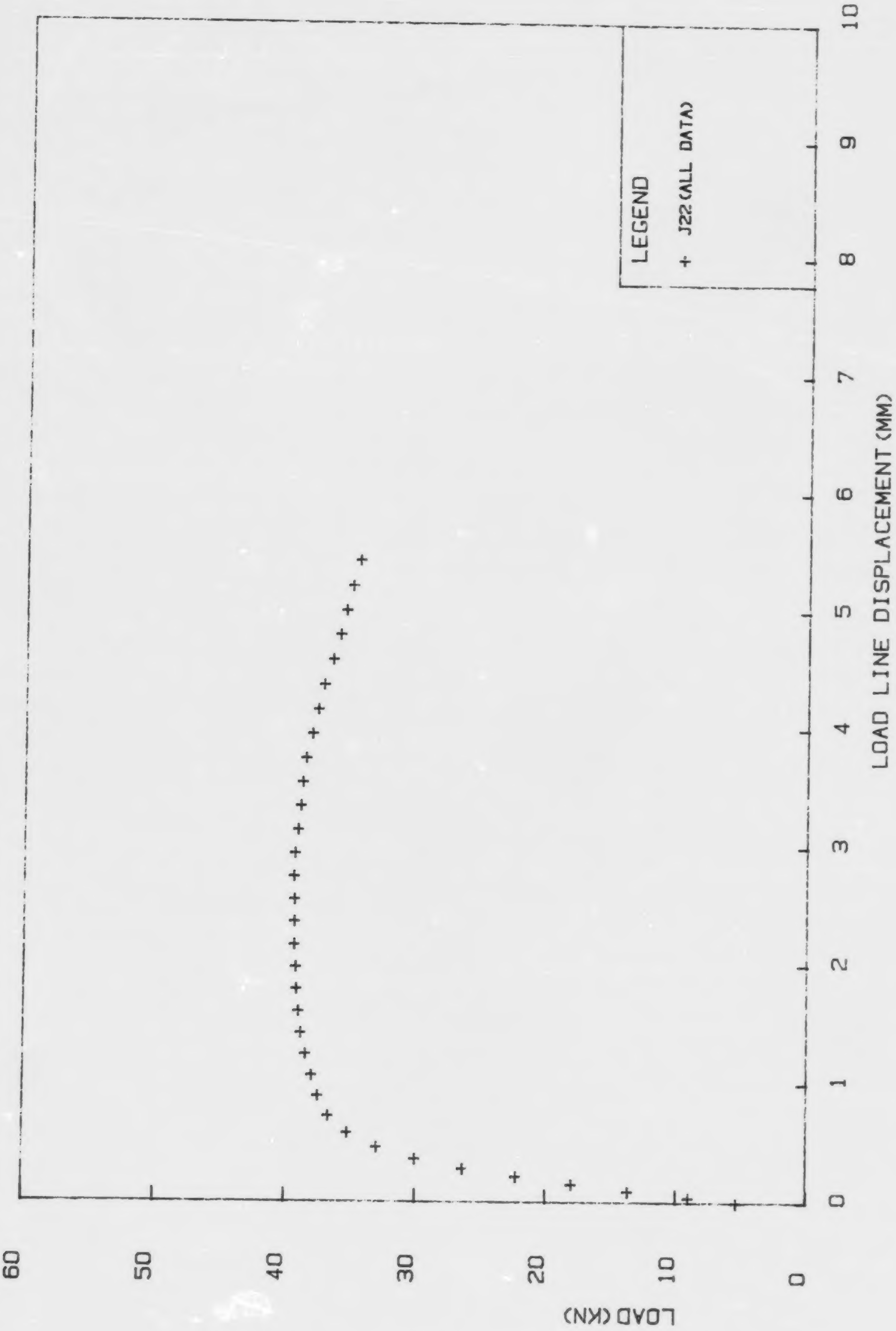
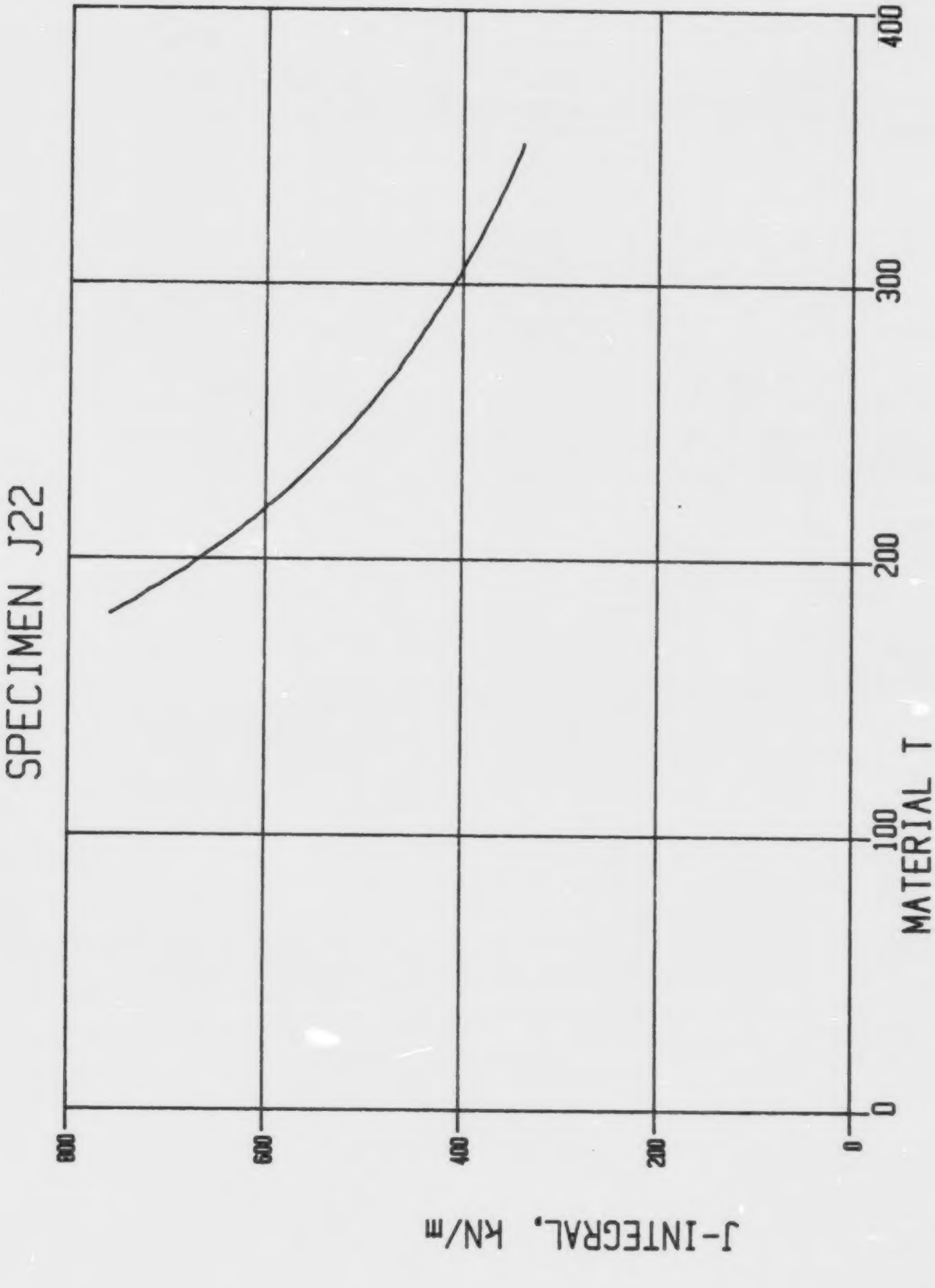

SPECIMEN J22(RT)
SLOPE 241
INTERCEPT 244
J1C 335
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J22 (ALL DATA)


SPECIMEN J22
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J22
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN107)
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	347.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	547.2
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	20.944
SPECIMEN WIDTH W(CM)	5.093
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.17827094E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	21.29
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.928

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.034
INITIAL A/W	.575
AVERAGE CRACK EXTENSION 9PT(CM)	.366
DELTA A(CM) COMPLIANCE	.349
MAX DEVIATION OF SINGLE MEASUREMENT %	6

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	17
LAST POINT	27
JIC(KN/M)	335
CORRELATION COEFF	.97
SLOPE M(MPa)	241
INTERCEPT B (KN/M)	244

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	449.24
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	406.18
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.165
25*JQ/EF.Y.(CM)	1.872

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	17
LAST DATA POINT USED	34
CONSTANT(C1)	490.08
EXPONENT(C2)	.5476

```
          J22(RT)

 K         J-ELASTIC     J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)  CR. LN
 (MPaRTM)  (KN/M)        (KN/M)        (KN/M)      (KN/M)          (KN/M)       (CM)

 22.05     2.3           .01            2.31        2.31         2.44     2.931   1
 33.45     5.29          -.18           5.11        5.11         5.41     2.934   2
 43.87     9.11          .56            9.67        9.67         10.2     2.928   3
 54.33     13.96         1.95           15.91       15.91        16.72    2.929   4
 64.32     19.57         4.2            23.77       23.78        24.92    2.93    5
 73.1      25.28         9.83           35.12       35.11        36.6     2.927   6
 80.51     30.67         19.71          50.38       50.4         52.16    2.932   7
 85.71     34.75         36.47          71.22       71.18        73.27    2.927   8
 89.36     37.78         59.65          97.43       97.42        99.64    2.928   9
 92        40.04         87.94          127.98      128.36       130.25   2.939   10
 93.23     41.12         120.31         161.43      161.84       163.76   2.939   11
 94.66     42.39         153.55         195.94      196.6        198.32   2.943   12
 96.88     44.4          184.28         228.69      231.12       231.03   2.961   13
 96.8      44.33         222.47         266.8       268.37       269.2    2.954   14
 98.4      45.81         255.99         301.8       305.55       304.15   2.97    15
 99.38     46.72         290.57         337.29      342.84       339.6    2.981   16
 100.34    47.63         326.22         373.85      381.01       376.14   2.99    17
 101.44    48.69         361.77         410.45      420.59       412.66   3.005   18
 102.42    49.63         396.34         445.97      459          448.13   3.017   19
 102.96    50.16         435.15         485.31      499.58       487.45   3.022   20
 103.85    51.02         470.85         521.87      539.8        523.95   3.036   21
 104.5     51.66         506.01         557.67      580.46       559.63   3.052   22
 105.14    52.3          542.68         594.98      622.33       596.85   3.066   23
 105.5     52.66         581.15         633.8       664.09       635.61   3.074   24
 107.38    54.55         608.67         663.22      704.96       664.92   3.105   25
 107.23    54.4          646.26         700.66      748.09       702.21   3.119   26
 107.83    55.01         679.18         734.19      790.54       735.59   3.14    27
 108.75    55.96         709.84         765.8       833.16       767.06   3.165   28
 108.18    55.37         746.61         801.97      876.78       803.03   3.181   29
 107.81    54.99         783.14         838.13      920.07       839.02   3.195   30
 108.28    55.47         813.98         869.45      961.67       870.2    3.214   31
 108.44    55.63         845.85         901.48      1003.72      902.08   3.232   32
 107.78    54.96         883.17         938.13      1046.98      938.56   3.244   33
 109.22    56.44         902.21         958.65      1088.13      959.01   3.277   34

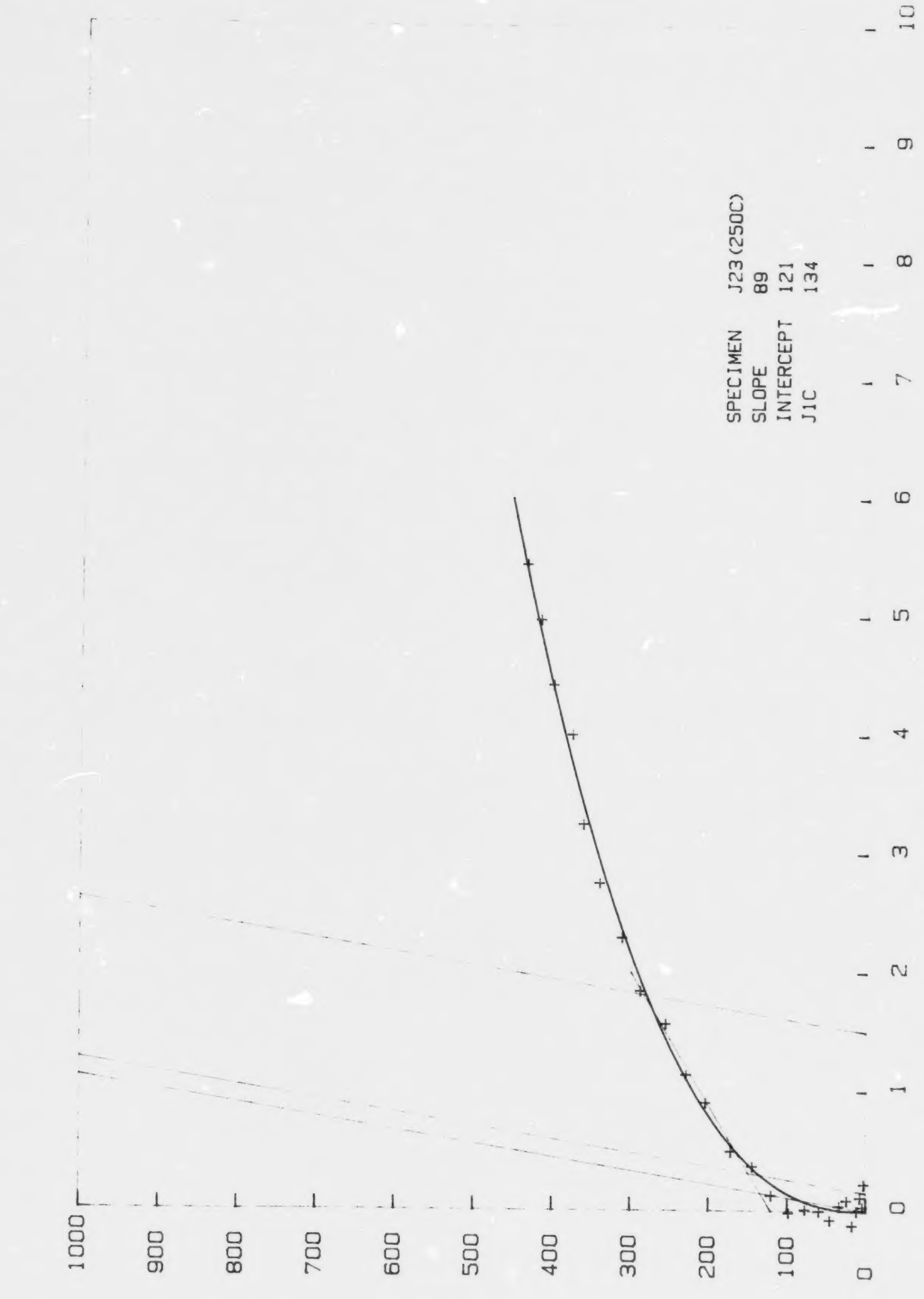
 H(M)            D(M)            POISSON'S RATIO
 .01904          2.54E-03        .3
```

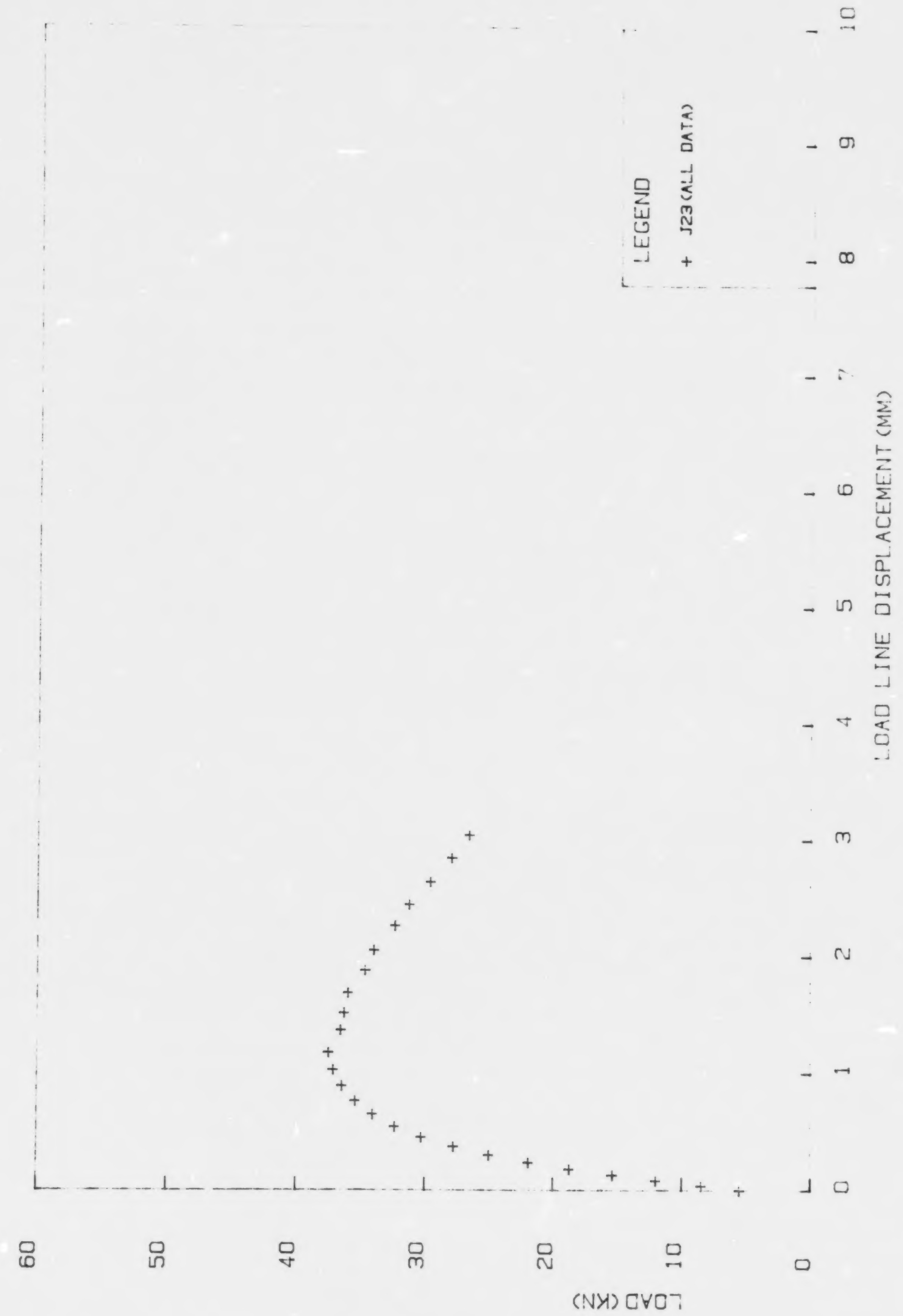
J22

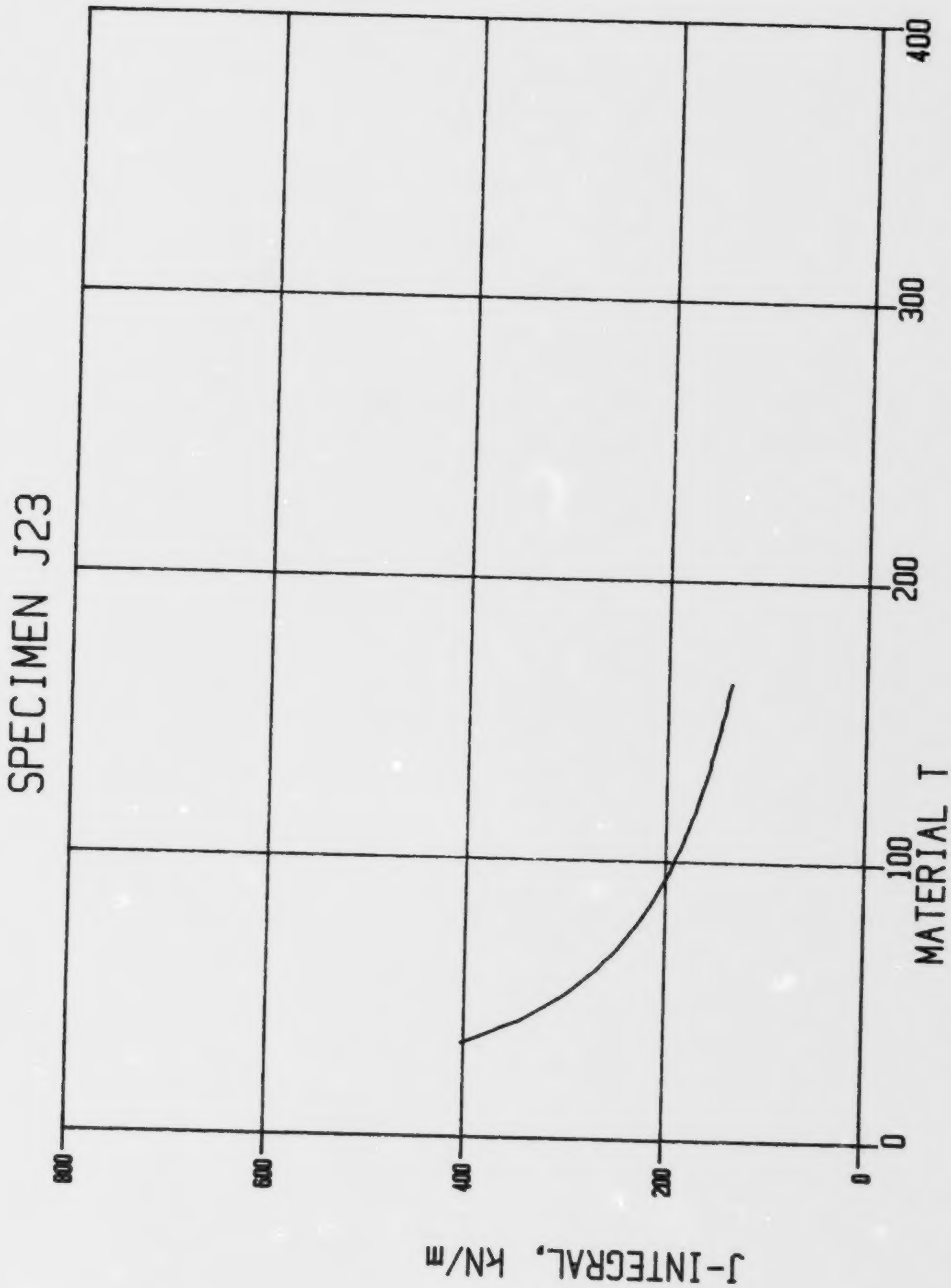
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.31	2.931	2.931	.032	.9995	1
5.11	2.934	2.934	.061	.9999	2
9.67	2.927	2.928	4E-03	.9999	3
15.91	2.928	2.929	.015	.9999	4
23.77	2.928	2.93	.019	.9999	5
35.12	2.925	2.927	-9E-03	.9999	6
50.38	2.929	2.932	.039	.9998	7
71.22	2.923	2.927	-.013	.9999	8
97.43	2.923	2.928	0	.9998	9
127.98	2.933	2.939	.107	.9999	10
161.43	2.933	2.939	.112	.9999	11
195.94	2.935	2.943	.146	.9999	12
228.69	2.952	2.961	.334	.9998	13
266.8	2.944	2.954	.258	.9998	14
301.8	2.958	2.97	.418	.9999	15
337.29	2.969	2.981	.531	1	16
373.85	2.976	2.99	.619	1	17
410.45	2.99	3.005	.766	.9999	18
445.97	3.001	3.017	.893	.9998	19
485.31	3.005	3.022	.943	1	20
521.87	3.017	3.036	1.076	.9999	21
557.67	3.032	3.052	1.238	.9999	22
594.98	3.045	3.066	1.379	.9999	23
633.8	3.052	3.074	1.463	.9999	24
663.22	3.082	3.105	1.769	.9999	25
700.66	3.095	3.119	1.913	.9999	26
734.19	3.115	3.14	2.123	.9999	27
765.8	3.139	3.165	2.368	.9998	28
801.97	3.153	3.181	2.525	.9998	29
838.13	3.166	3.195	2.667	.9998	30
869.45	3.185	3.214	2.861	.9998	31
901.48	3.202	3.232	3.042	.9999	32
938.13	3.212	3.244	3.156	.9998	33
958.65	3.245	3.277	3.495	.9999	34

```
             LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J22
 1            5.31          0
 2            9.033          .044
 3           13.672          .095
 4           18.005          .154
 5           22.278          .217
 6           26.367          .283
 7           30.029          .364
 8           32.959          .461
 9           35.217          .581
 10          36.682          .725
 11          37.476          .891
 12          37.964         1.064
 13          38.452         1.243
 14          38.818         1.421
 15          39.001         1.604
 16          39.185         1.792
 17          39.246         1.978
 18          39.368         2.166
 19          39.368         2.361
 20          39.368         2.549
 21          39.429         2.744
 22          39.368         2.939
 23          39.124         3.137
 24          38.94          3.34
 25          38.818         3.54
 26          38.574         3.743
 27          38.086         3.95
 28          37.659         4.158
 29          37.231         4.368
 30          36.56          4.58
 31          36.011         4.792
 32          35.583         5
 33          35.095         5.21
 34          34.546         5.425
 35          33.997         5.64
```

	J(KN/M)	T	W	J22
1	319.55	301.08	20.71	
2	355.57	397.6	24.48	
3	392.15	239.94	13.3	
4	428.21	268.11	13.53	
5	465.64	761.55	35.25	
6	503.59	264.17	11.23	
7	539.77	211.16	8.31	
8	576.32	254.92	9.33	
9	614.39	442.84	15.15	
10	648.51	92.38	2.95	
11	681.94	250.98	7.56	
12	717.43	153.26	4.34	
13	750	123.77	3.31	
14	783.89	221.31	5.62	
15	820.05	244.61	5.89	
16	853.79	154.88	3.55	
17	885.47	170.34	3.73	
18	919.81	309.63	6.48	
19	948.39	58.16	1.16	


SPECIMEN J23(250C)
SLOPE 89
INTERCEPT 121
J1C 134
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J23 (ALL DATA)


SPECIMEN J23
0
100
200
300
400
MATERIAL T
0
200
400
600
800
J-INTEGRAL, kN/m

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                 J23
 MATERIAL TYPE                                   A106B
 MATERIAL CONDITION                              WELD(PN107)
 TEST TEMPERATURE(DEG C)                         250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)       353.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)     542.3
 CRACK PLANE ORIENTATION (PER ASTM E399)         L-C
 SPECIMEN THICKNESS B(CM)                        2.54
 PERCENT SIDE GROOVE                             20.787
 SPECIMEN WIDTH W(CM)                            5.092
 YOUNGS MODULUS AT TEST TEMP(Pa)                 1.82776E+11
 EFFECTIVE MODULUS(Pa)                           1.95745047E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN           10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM        21.48
 INITIAL CRACK LENGTH-COMPLIANCE(CM)             2.94

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                  3.015
 INITIAL A/W                                     .577
 AVERAGE CRACK EXTENSION 9PT(CM)                 .552
 DELTA A(CM) COMPLIANCE                          .543
 MAX DEVIATION OF SINGLE MEASUREMENT %           4.3

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   13
 LAST POINT                    17
 JIC(KN/M)                     134
 CORRELATION COEFF             .97
 SLOPE M(MPa)                  89
 INTERCEPT B (KN/M)            121

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD      YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD         YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                        NO
 CRACK SIZE DA<0.15*DELTA A                      YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                 450.69
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M               360.31
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                2.152
 25*JQ/EF.Y.(CM)                                 .748

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      13
 LAST DATA POINT USED     25
 CONSTANT(C1)             219.64
 EXPONENT(C2)             .4056
```

J23(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
21.18	2.23	-.03	2.2	2.2	2.28	2.962	1
29.6	4.36	.21	4.58	4.58	4.8	2.943	2
38.08	7.22	.51	7.73	7.73	8.11	2.951	3
46.02	10.54	1.57	12.11	12.11	12.71	2.94	4
53.35	14.17	3.58	17.75	17.73	18.57	2.928	5
61.86	19.05	5.71	24.76	24.79	25.83	2.949	6
68.42	23.31	11.09	34.39	34.41	35.72	2.944	7
73.95	27.22	19.09	46.32	46.25	47.9	2.932	8
79.46	31.43	28.82	60.26	60.28	62.07	2.94	9
83.73	34.9	42.98	77.88	77.92	79.89	2.941	10
86.85	37.56	60.99	98.55	98.52	100.73	2.939	11
90.34	40.63	80.08	120.71	121.22	123	2.953	12
93.64	43.66	100.93	144.59	146.29	146.94	2.977	13
95.43	45.34	126.34	171.68	174.15	174.07	2.989	14
95.85	45.75	158.19	203.94	209.65	206	3.03	15
96.92	46.77	182.18	228.95	236.99	230.95	3.054	16
99.39	49.18	206.07	255.25	268.32	257.12	3.097	17
97.78	47.6	240.11	287.71	304.46	289.23	3.124	18
99.44	49.23	262.16	311.39	335.23	312.74	3.169	19
98.28	48.09	292.47	340.55	372.43	341.43	3.215	20
99.05	48.84	312.97	361.81	403.6	362.46	3.265	21
100.32	50.11	326.22	376.33	434.61	376.78	3.34	22
98.43	48.23	352.57	400.8	468.88	400.78	3.382	23
98.68	48.48	368.9	417.38	499.65	417.12	3.437	24
98.3	48.11	387.29	435.4	530.65	434.85	3.483	25

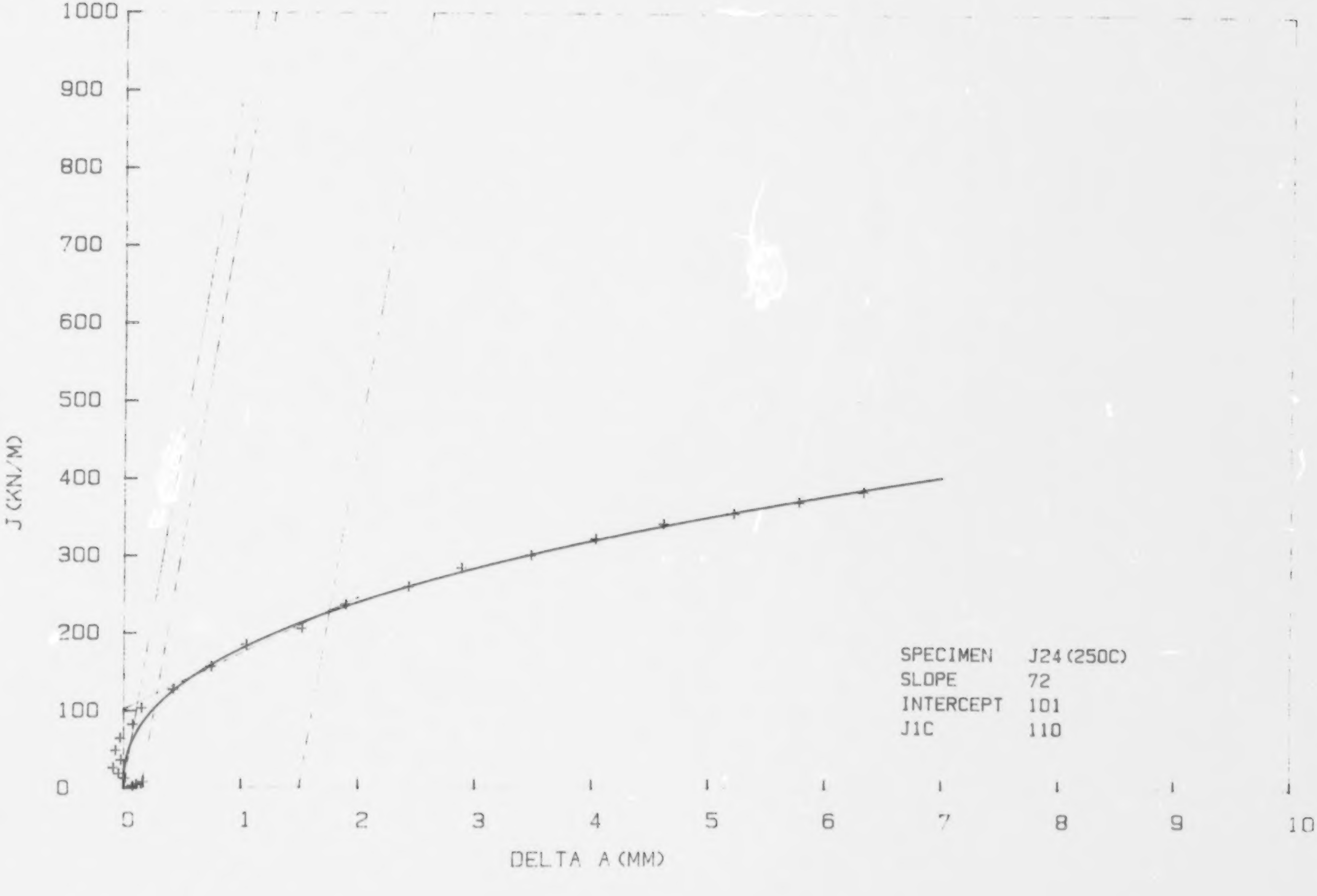
H(M)	D(M)	POISSON´S RATIO
.01903	2.54E-03	.3

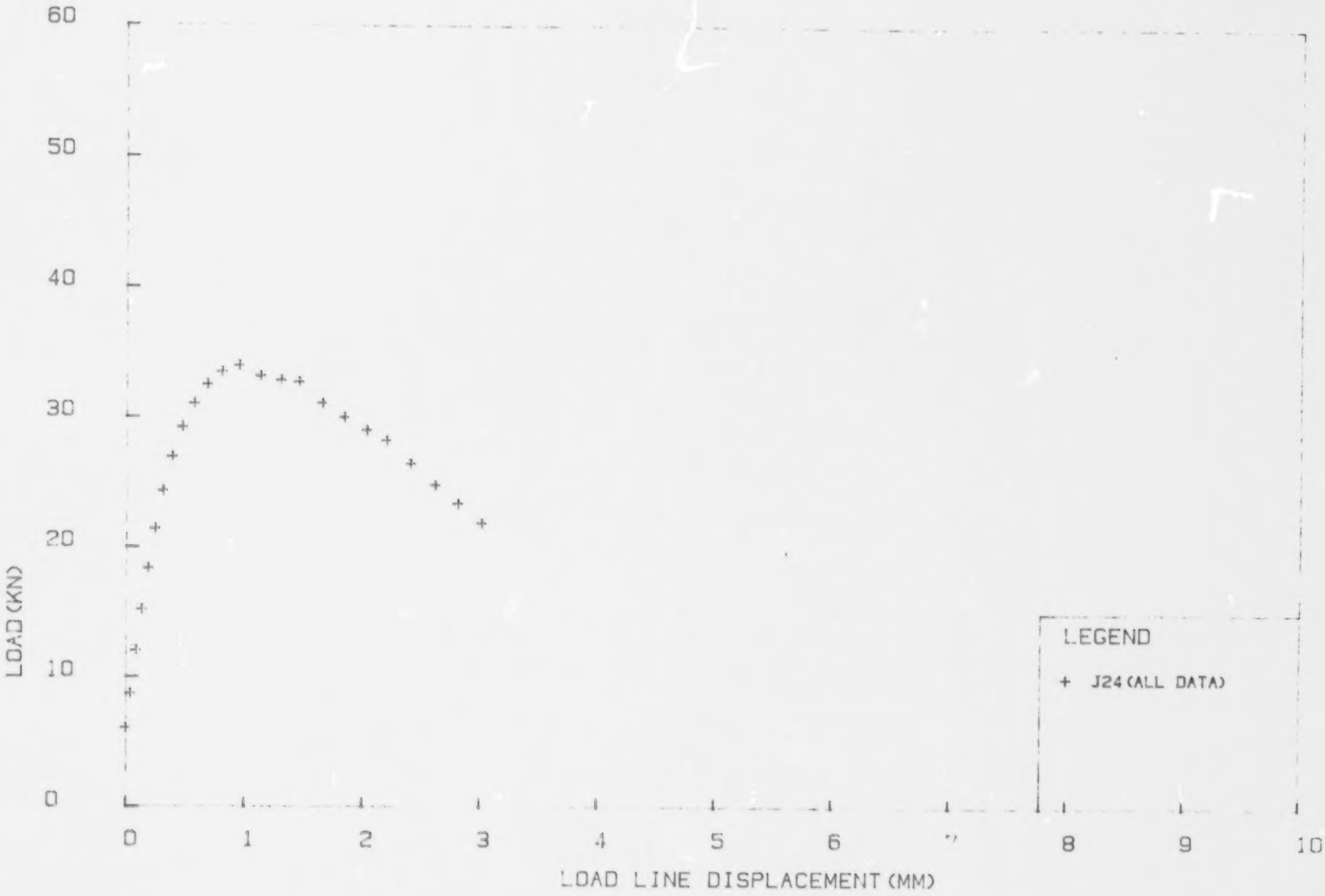
J23

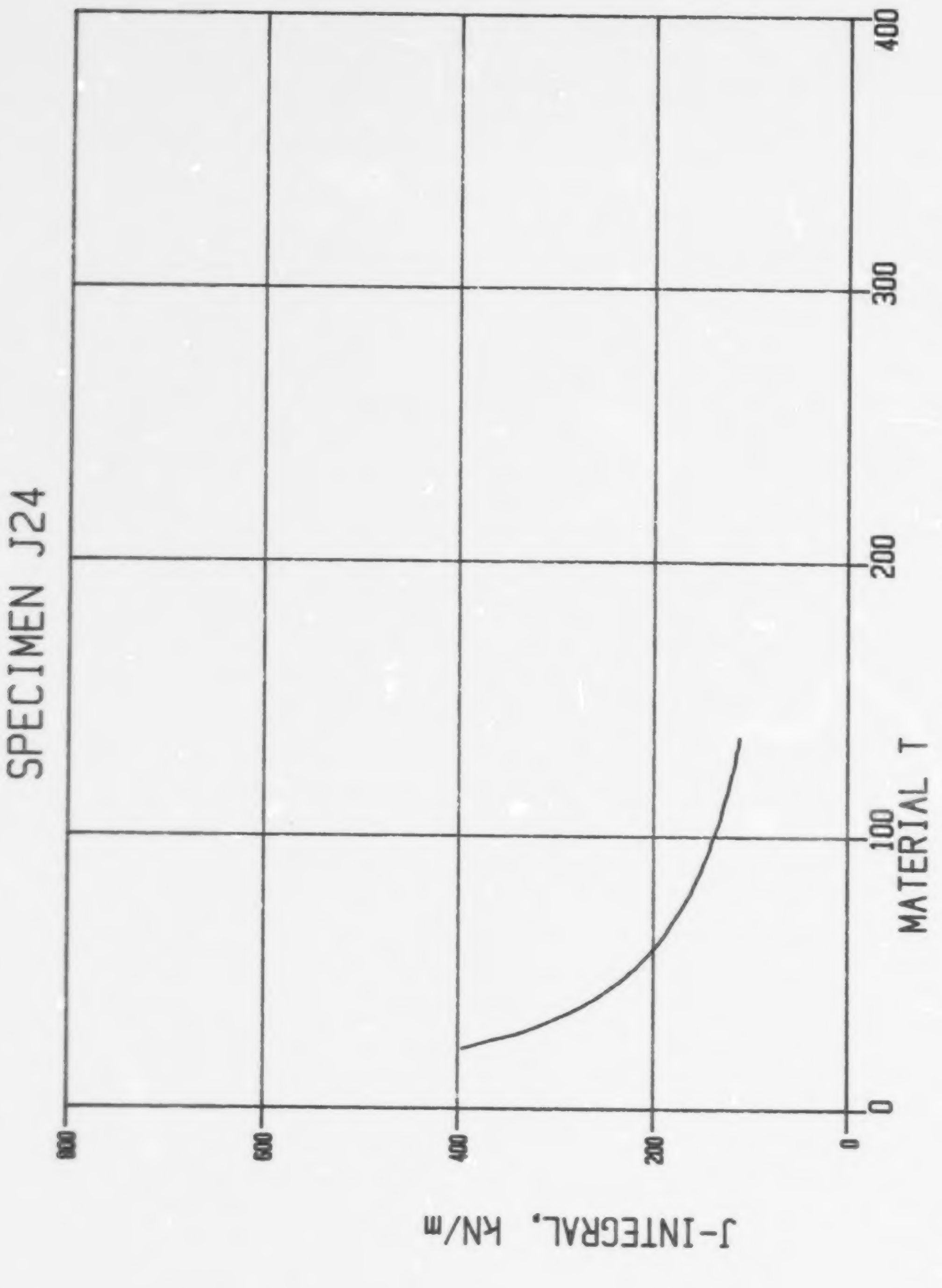
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.2	2.962	2.962	.223	.9987	1
4.58	2.943	2.943	.034	.9995	2
7.73	2.95	2.951	.112	.9996	3
12.11	2.939	2.94	0	.9997	4
17.75	2.927	2.928	-.12	.9997	5
24.76	2.947	2.949	.089	.9998	6
34.39	2.942	2.944	.043	.9993	7
46.32	2.93	2.932	-.075	.9996	8
60.26	2.937	2.94	2E-03	.9997	9
77.88	2.937	2.941	.013	.9997	10
98.55	2.934	2.939	-.015	.9998	11
120.71	2.947	2.953	.129	.9998	12
144.59	2.971	2.977	.37	.9998	13
171.68	2.982	2.989	.492	.9998	14
203.94	3.022	3.03	.903	.9998	15
228.95	3.045	3.054	1.136	.9995	16
255.25	3.087	3.097	1.567	.9997	17
287.71	3.113	3.124	1.842	.9998	18
311.39	3.158	3.169	2.291	.9998	19
340.55	3.203	3.215	2.749	.9998	20
361.81	3.252	3.265	3.246	.9998	21
376.33	3.327	3.34	4.002	.9998	22
400.8	3.368	3.382	4.419	.9998	23
417.38	3.422	3.437	4.968	.9998	24
435.4	3.469	3.483	5.435	.9999	25

```
            LOAD(KN)        LOAD LINE DISPLACEMENT(MM)       J23
 1           5.493           0
 2           8.484            .037
 3           12.024           .083
 4           15.381           .131
 5           18.738           .182
 6           21.912           .237
 7           25.024           .3
 8           27.771           .372
 9           30.273           .452
 10          32.349           .542
 11          34.058           .647
 12          35.4             .763
 13          36.438           .89
 14          37.109          1.028
 15          37.476          1.174
 16          36.499          1.367
 17          36.255          1.514
 18          35.95           1.686
 19          34.607          1.879
 20          33.936          2.052
 21          32.288          2.262
 22          31.189          2.445
 23          29.541          2.64
 24          27.893          2.845
 25          26.55           3.042
 26          25.269          3.241
```

	J(KN/M)	T	W	J23
1	132.65	90.15	15.78	
2	158.13	202.23	29.53	
3	187.81	71.49	8.62	
4	216.44	98.02	10.14	
5	242.1	55.51	5.02	
6	271.48	107.73	8.57	
7	299.55	47.99	3.38	
8	325.97	58	3.67	
9	351.18	38.98	2.23	
10	369.07	17.47	.91	
11	388.56	53.42	2.58	
12	409.09	27.54	1.22	
13	426.39	35.15	1.46	


J (KN/M)
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J24 (250C)
SLOPE 72
INTERCEPT 101
J1C 110


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J24 (ALL DATA)


SPECIMEN J24
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

              TEST SPECIMEN DATA

  SPECIMEN NUMBER                                      J24
  MATERIAL TYPE                                        A106B
  MATERIAL CONDITION                                   WELD(PN107)
  TEST TEMPERATURE(DEG C)                              250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            353.7
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          542.3
  CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
  SPECIMEN THICKNESS B(CM)                             2.541
  PERCENT SIDE GROOVE                                  20.7
  SPECIMEN WIDTH W(CM)                                 5.091
  YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
  EFFECTIVE MODULUS(Pa)                                1.98201111E+11

              FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             22.78
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.02

              CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                       3.09
  INIT!AL A/W                                          .593
  AVERAGE CRACK EXTENSION 9PT(CM)                      .623
  DELTA A(CM) COMPLIANCE                               .632
  MAX DEVIATION OF SINGLE MEASUREMENT %                2.9

              ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                         12
  LAST POINT                          15
  JIC(KN/M)                           110
  CORRELATION COEFF                   .97
  SLOPE M(MPa)                        72
  INTERCEPT B (KN/M)                  101

              VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD            YES
  LIGAMENT>25JIC/EFFECTIVE YIELD      YES
  DJ/DA<EFFECTIVE YIELD               YES

              QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                             NO
  CRACK SIZE DA<0.15*DELTA A                           YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      451.36
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    322.24
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.071
  25*JQ/EF.Y.(CM)                                      .614

              CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED           12
  LAST DATA POINT USED          24
  CONSTANT(C1)                  180
  EXPONENT(C2)                  .4152
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        J24(250C)

K          J-ELASTIC       J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)          (KN/M)        (KN/M)     (KN/M)          (KN/M)        (CM)

22.87      2.6             .03           2.63       2.63          2.77      3.028  1
31.59      4.97            .13           5.1        5.1           5.39      3.031  2
40.1       8.01            .32           8.33       8.33          8.81      3.037  3
47.91      11.43           1.72          13.15      13.15         13.87     3.022  4
55.64      15.41           3.6           19.01      19            20        3.016  5
63.02      19.78           7.02          26.8       26.78         28.06     3.011  6
70.17      24.51           12.26         36.78      36.79         38.33     3.018  7
75.78      28.59           20.6          49.19      49.17         51.01     3.014  8
80.76      32.47           32.47         64.95      64.97         67        3.017  9
85.25      36.18           46.49         82.68      82.92         84.93     3.028  10
88.32      38.83           65.07         103.91     104.37        106.29    3.036  11
91.48      41.66           86.13         127.8      129.38        130.19    3.063  12
91.45      41.64           115.6         157.24     160.61        159.35    3.095  13
92.76      42.84           142.68        185.52     191.11        187.47    3.124  14
96.04      45.92           160.29        206.22     216.26        208.11    3.172  15
94.07      44.05           192.83        236.89     250.93        238.28    3.209  16
95.01      44.94           215.08        260.02     281.13        261.08    3.263  17
95.64      45.54           239.07        284.61     312.5         285.34    3.308  18
98.16      47.97           253.19        301.16     339.12        301.78    3.367  19
96.9       46.75           276.01        322.76     370.95        322.87    3.423  20
96.16      46.04           296.31        342.35     402.57        342       3.481  21
96.4       46.27           310.03        356.3      430.26        355.71    3.541  22
95.52      45.42           326.02        371.44     459.05        370.5     3.597  23
94.42      44.38           340.33        384.72     487.2         383.47    3.652  24

H(M)           D(M)            POISSON'S RATIO
.01905         2.54E-03        .3
```

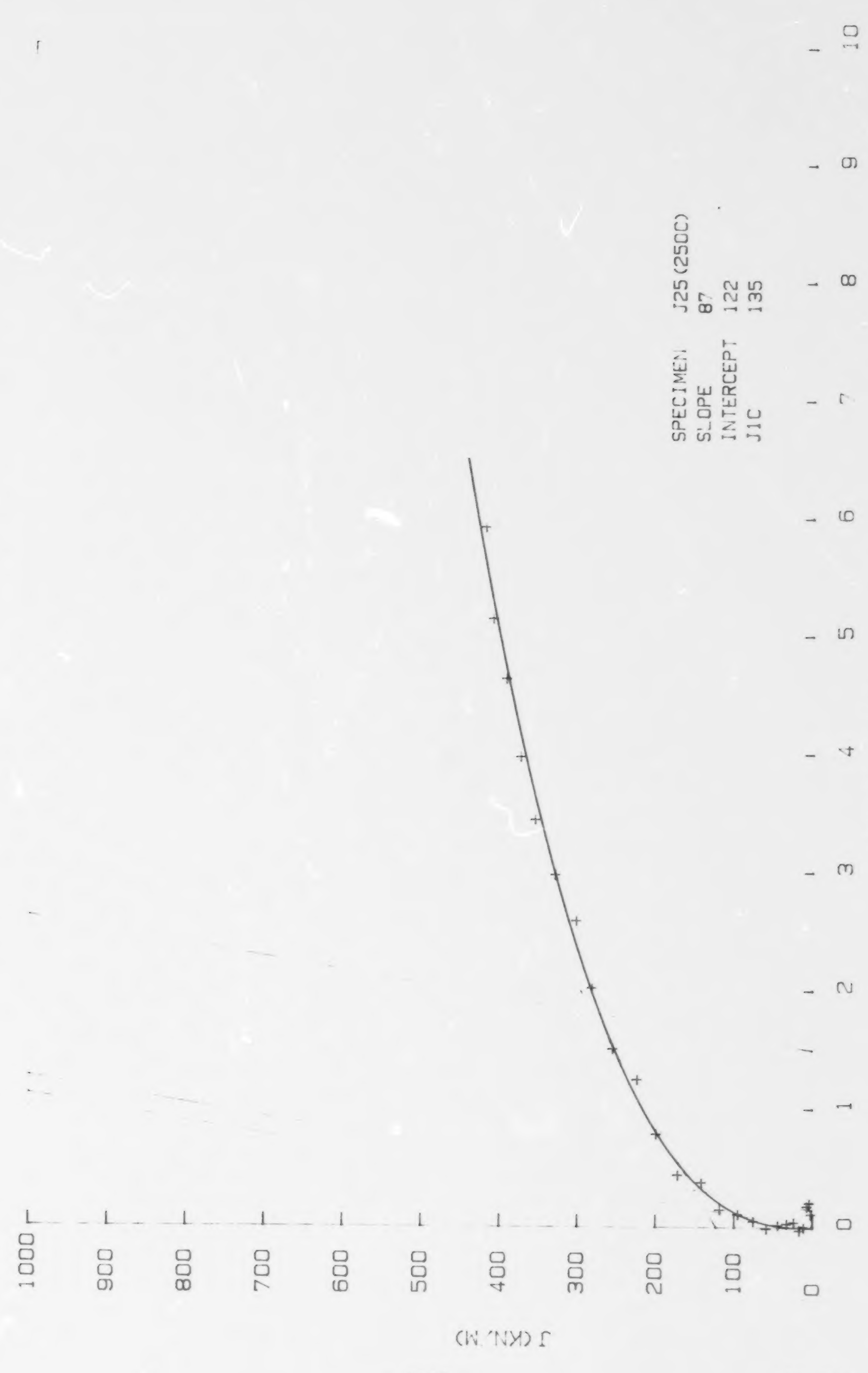
J24

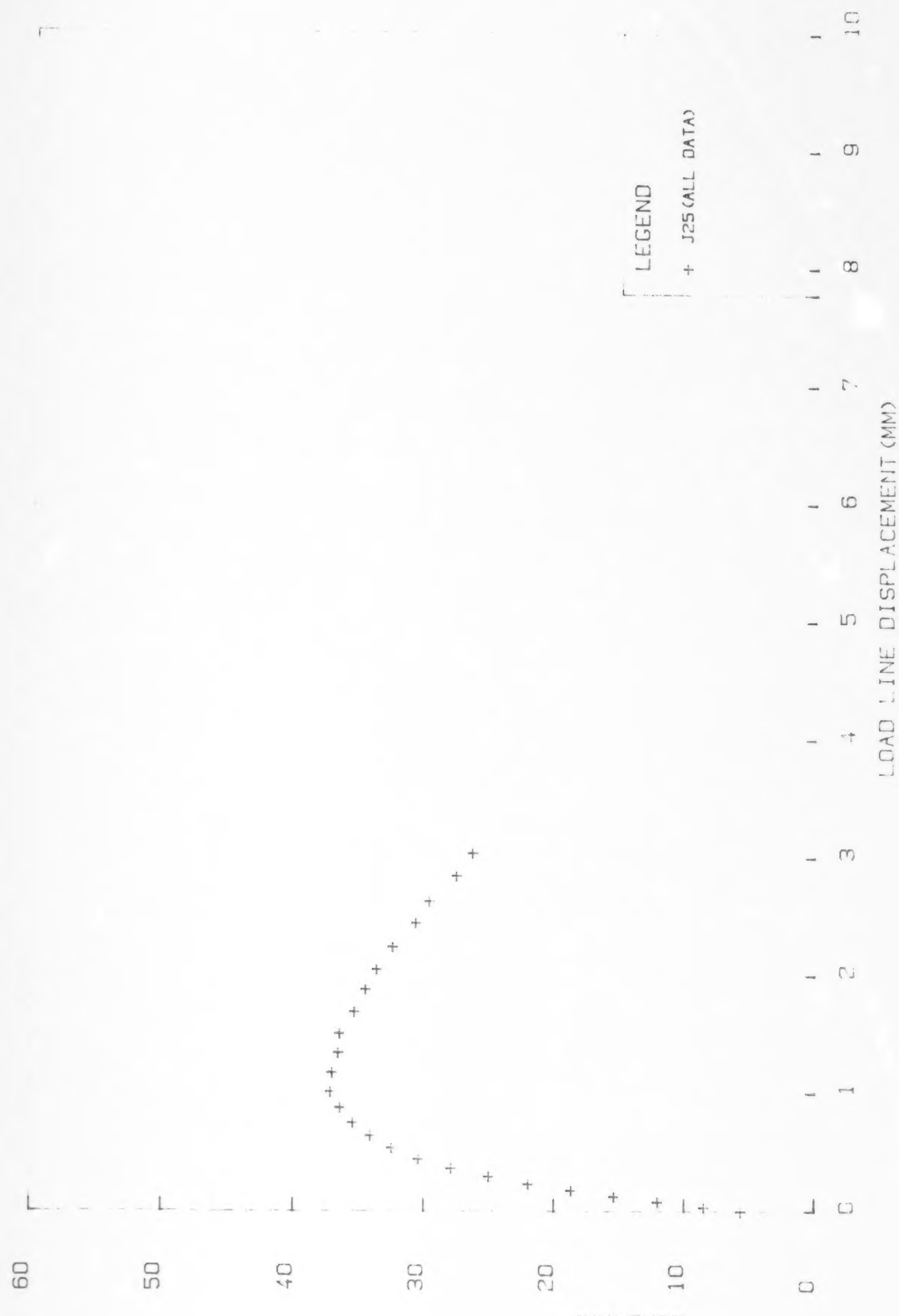
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.63	3.028	3.028	.081	.9991	1
5.1	3.031	3.031	.112	.9997	2
8.33	3.036	3.037	.171	.9996	3
13.15	3.021	3.022	.016	1	4
19.01	3.015	3.016	-.039	.9998	5
26.8	3.01	3.011	-.086	.9998	6
36.78	3.016	3.018	-.019	.9994	7
49.19	3.011	3.014	-.065	.9997	8
64.95	3.014	3.017	-.026	.9997	9
82.68	3.024	3.028	.08	.9999	10
103.91	3.031	3.036	.156	1	11
127.8	3.057	3.063	.425	.9997	12
157.24	3.088	3.095	.748	.9999	13
185.52	3.117	3.124	1.044	.9998	14
206.22	3.164	3.172	1.518	.9997	15
236.89	3.2	3.209	1.89	.9999	16
260.02	3.253	3.263	2.429	.9999	17
284.61	3.298	3.308	2.882	.9997	18
301.16	3.357	3.367	3.475	.9998	19
322.76	3.412	3.423	4.028	.9999	20
342.35	3.469	3.481	4.611	.9999	21
356.3	3.529	3.541	5.212	.9996	22
371.44	3.584	3.597	5.76700001	.9998	23
384.72	3.64	3.652	6.324	.9998	24

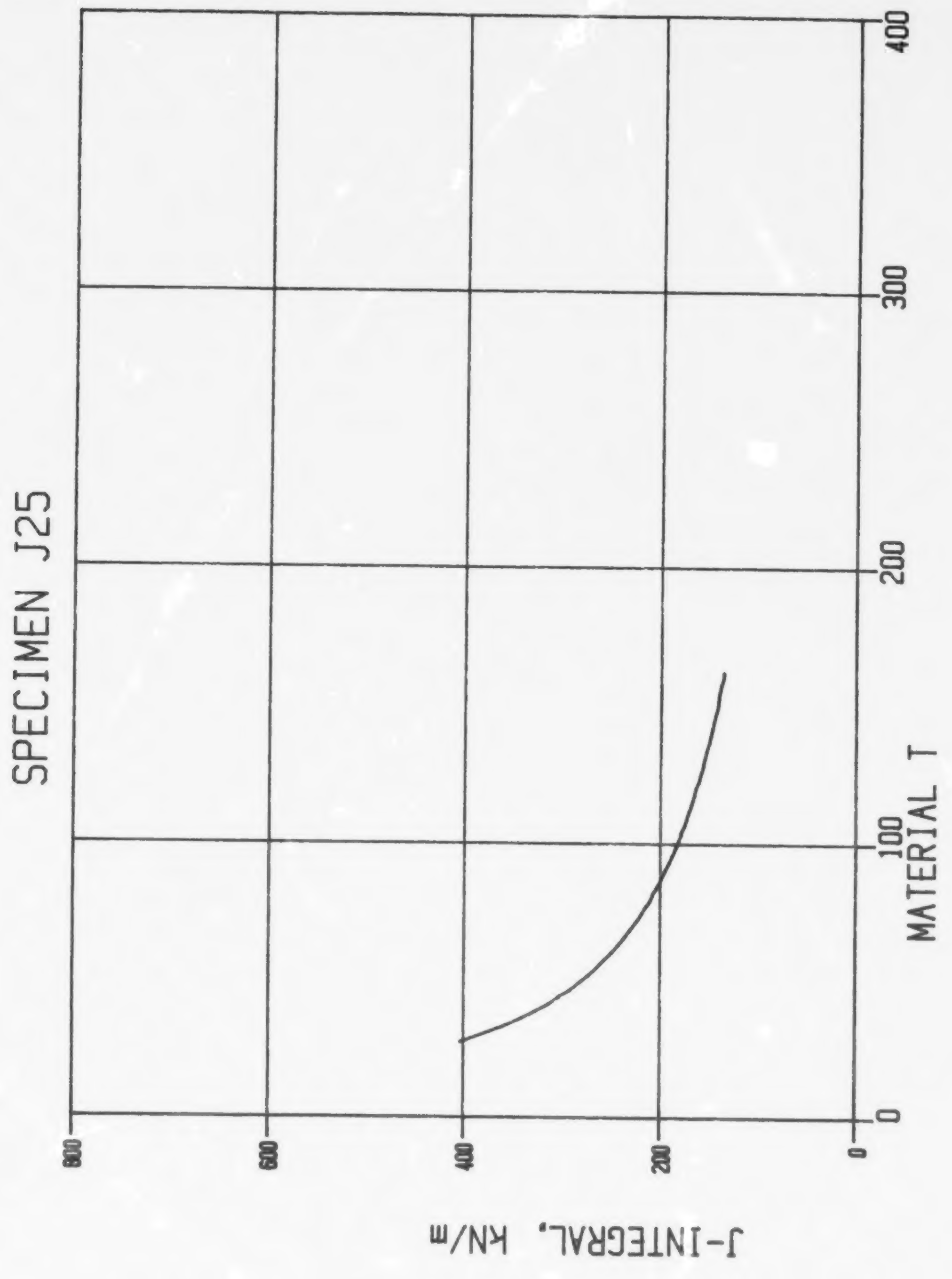
J24

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	6.042	0
2	8.728	.038
3	12.024	.085
4	15.198	.133
5	18.372	.188
6	21.423	.245
7	24.353	.311
8	26.978	.388
9	29.236	.472
10	31.067	.574
11	32.532	.684
12	33.508	.808
13	33.997	.953
14	33.142	1.133
15	32.837	1.309
16	32.715	1.459
17	31.067	1.659
18	29.968	1.844
19	28.992	2.036
20	28.198	2.207
21	26.428	2.41
22	24.78	2.62
23	23.376	2.812
24	21.851	3.016
25	20.325	3.224

	J(KN/M)	T	W	J24
1	115.85	80.68	15.51	
2	142.52	83.04	12.77	
3	171.38	87.18	10.99	
4	195.87	39.73	4.27	
5	221.55	75.09	7	
6	248.46	39.08	3.16	
7	272.32	49.46	3.56	
8	292.89	25.43	1.64	
9	311.96	35.52	2.09	
10	332.56	30.62	1.63	
11	349.32	21.12	1.03	
12	363.87	24.87	1.12	
13	378.08	21.7	.91	


SPECIMEN J25(250C)
SLOPE 87
INTERCEPT 122
J1C 135
DELTA A (MM)
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J25 (ALL DATA)


SPECIMEN J25

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                     J25
 MATERIAL TYPE                                       A106B
 MATERIAL CONDITION                                  WELD(PN107)
 TEST TEMPERATURE(DEG C)                             250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           353.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         542.3
 CRACK PLANE ORIENTATION (PER ASTM E399)             L-C
 SPECIMEN THICKNESS B(CM)                            2.54
 PERCENT SIDE GROOVE                                 20.472
 SPECIMEN WIDTH W(CM)                                5.09
 YOUNGS MODULUS AT TEST TEMP(Pa)                     1.82776E+11
 EFFECTIVE MODULUS(Pa)                               2.06579902E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN               10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            21.26
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                 2.924

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                      3.0365
 INITIAL A/W                                         .574
 AVERAGE CRACK EXTENSION 9PT(CM)                     .564
 DELTA A(CM) COMPLIANCE                              .591
 MAX DEVIATION OF SINGLE MEASUREMENT %               3.9

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    13
 LAST POINT                     17
 JIC(KN/M)                      135
 CORRELATION COEFF              .94
 SLOPE M(MPa)                   87
 INTERCEPT B (KN/M)             122

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                            YES
 CRACK SIZE DA<0.15*DELTA A                          YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     452.48
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   352.69
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.166
 25*JQ/EF.Y.(CM)                                     .753

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       13
 LAST DATA POINT USED      25
 CONSTANT(C1)              216.8
 EXPONENT(C2)              .3831
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J25(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
20.75	2.14	0	2.14	2.14	2.24	2.936	1
29.61	4.36	-.07	4.3	4.3	4.51	2.945	2
37.8	7.11	.3	7.41	7.41	7.78	2.942	3
45.32	10.22	1.59	11.81	11.81	12.38	2.925	4
53.21	14.1	3.2	17.29	17.29	18.09	2.922	5
60.9	18.47	5.91	24.37	24.38	25.4	2.929	6
67.83	22.9	10.45	33.35	33.35	34.63	2.928	7
73.85	27.15	17.57	44.72	44.72	46.24	2.926	8
78.71	30.84	28.61	59.45	59.41	61.19	2.923	9
83.09	34.38	41.71	76.09	76.16	78	2.93	10
86.72	37.44	58.04	95.48	95.7	97.55	2.935	11
89.35	39.74	78.64	118.38	118.73	120.57	2.939	12
92.67	42.76	98.76	141.52	142.98	143.78	2.962	13
92.79	42.87	128.88	171.75	173.58	173.96	2.968	14
93.95	43.94	155.64	199.58	204.17	201.63	3.003	15
97.12	46.96	177.11	224.07	233.17	226.03	3.049	16
95.94	45.82	209.68	255.5	267.53	257.18	3.075	17
97.49	47.32	235	282.32	301.3	283.72	3.126	18
99.59	49.38	253.33	302.7	330.49	303.95	3.183	19
99.13	48.92	281.1	330.03	364.41	330.94	3.221	20
97.53	47.36	308.5	355.86	399.2	356.31	3.268	21
98.76	48.56	326.03	374.59	429.38	374.85	3.321	22
97.55	47.38	345.93	393.31	463.45	393.1	3.387	23
97.84	47.66	362.95	410.61	493.71	410.16	3.438	24
98.28	48.09	372.65	420.74	525.08	420.13	3.515	25

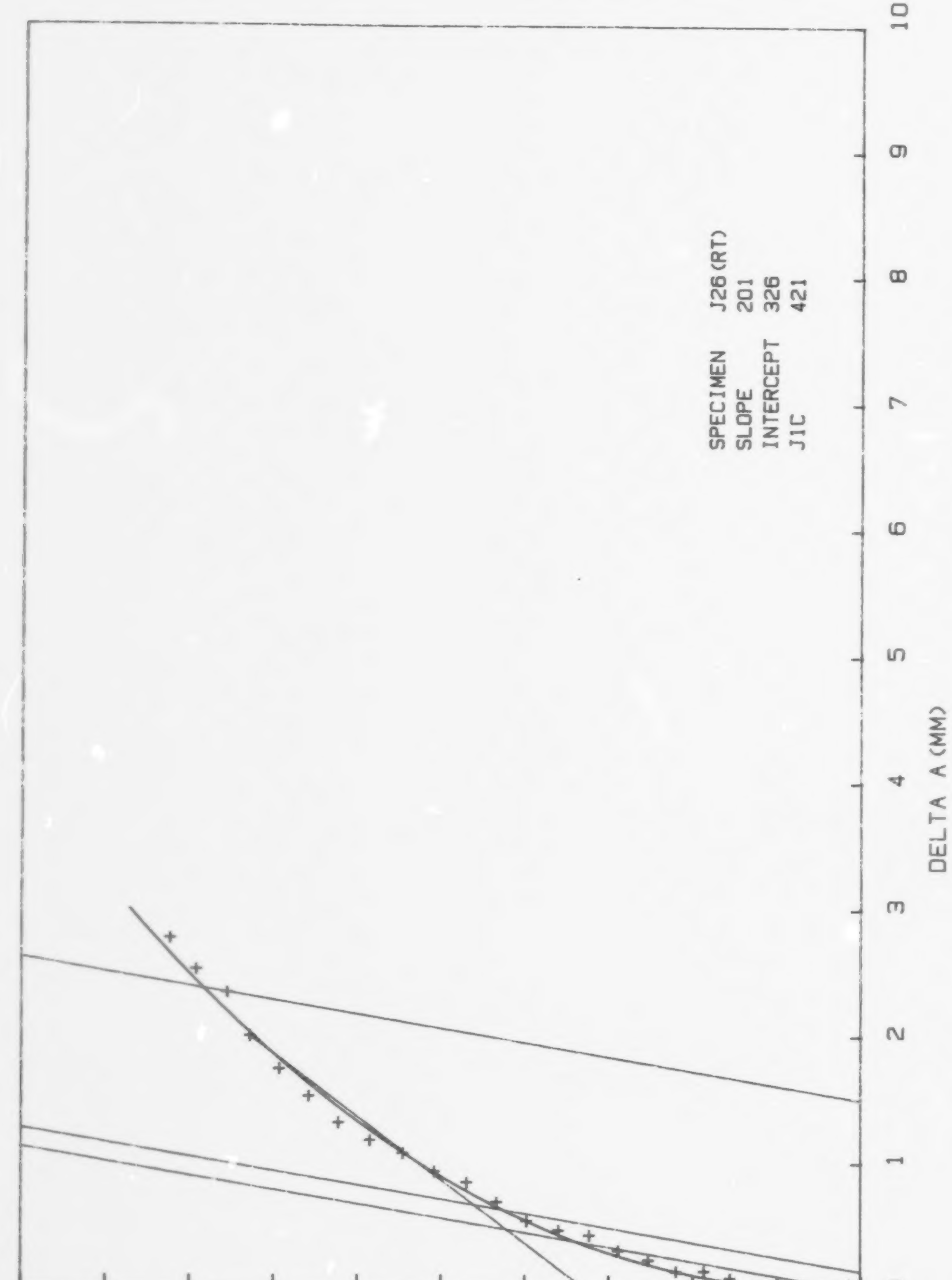
H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

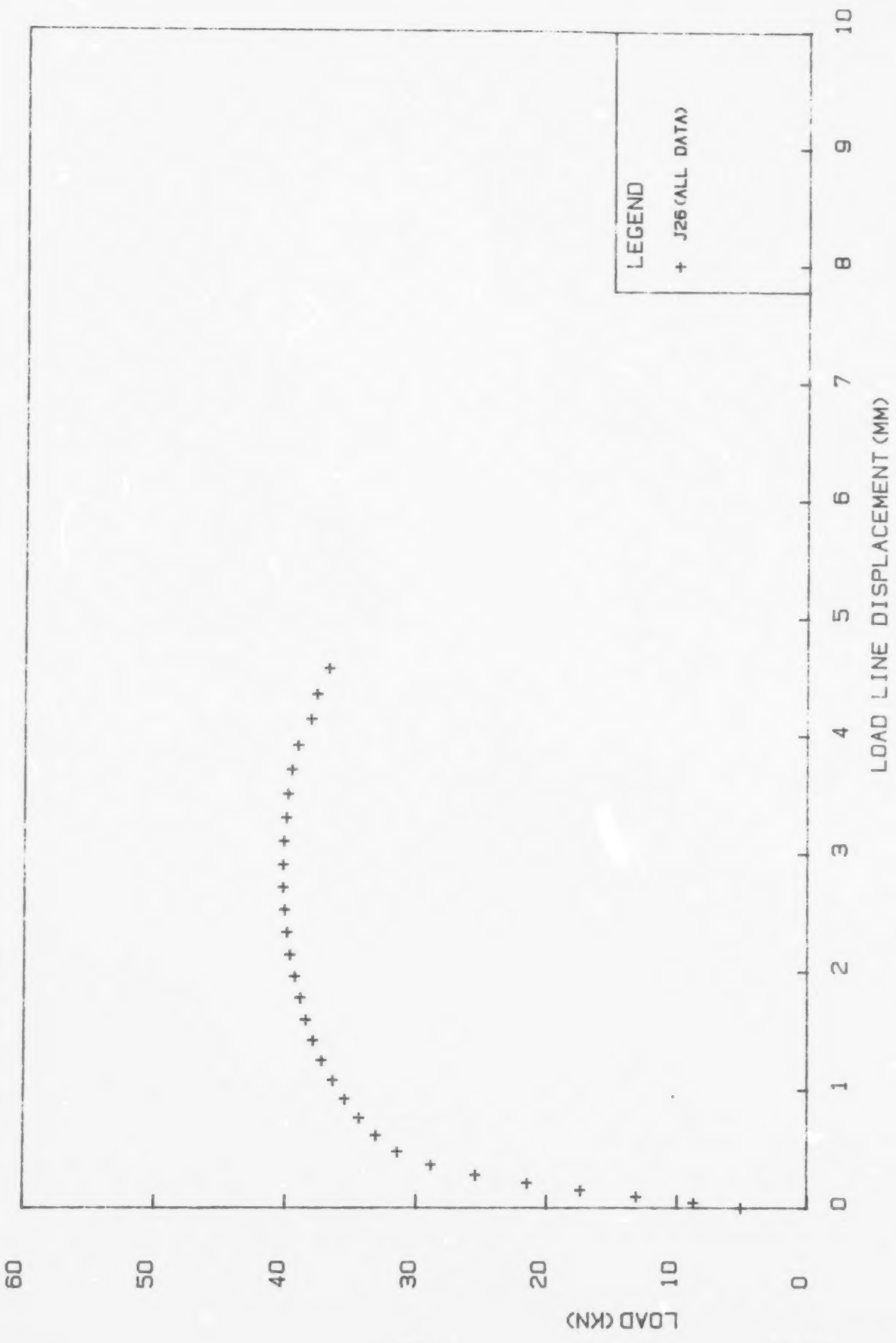
J25

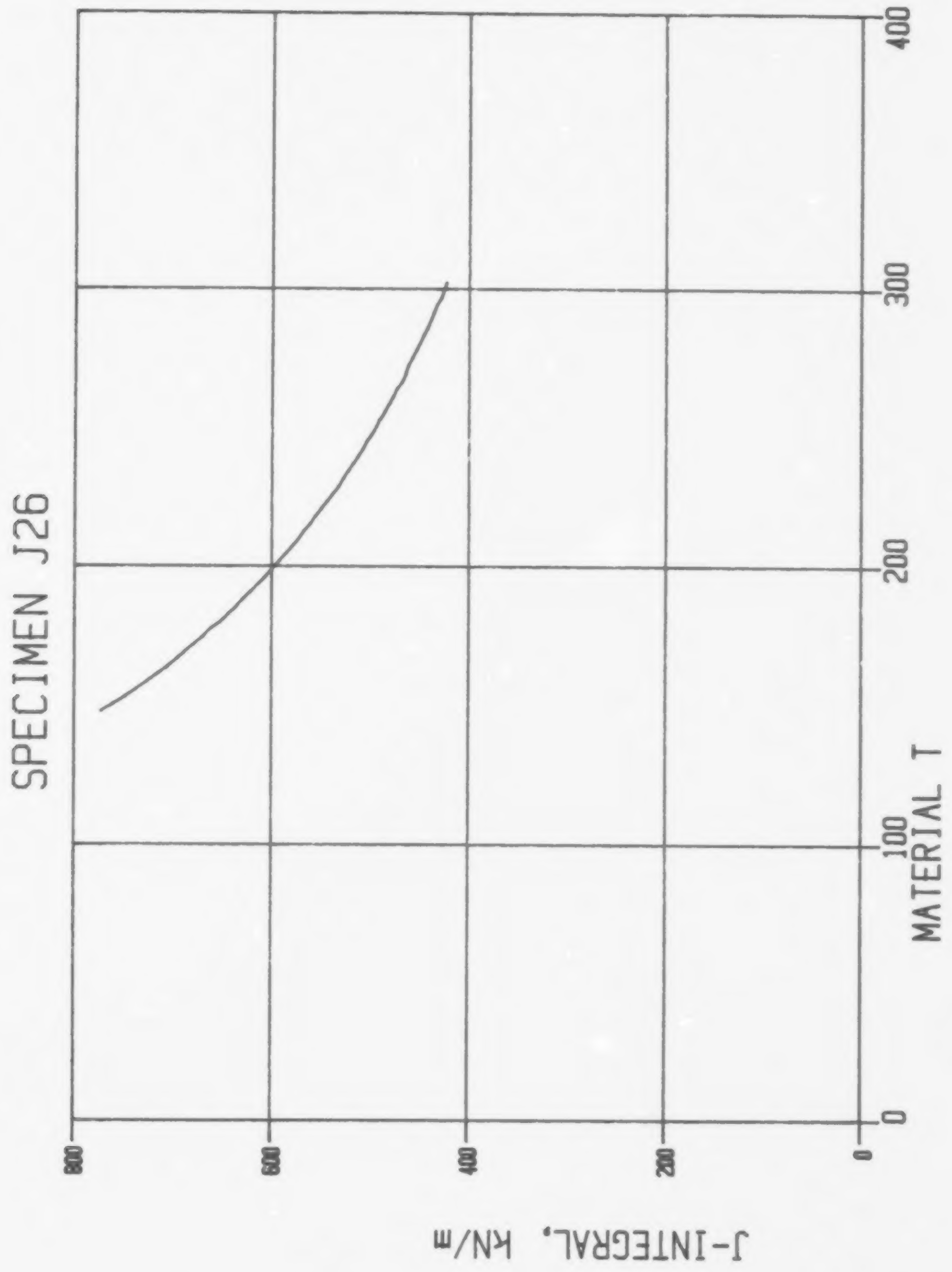
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.14	2.935	2.936	.117	.9995	1
4.3	2.944	2.945	.21	.9998	2
7.41	2.941	2.942	.181	.9997	3
11.81	2.923	2.925	5E-03	.9996	4
17.29	2.92	2.922	-.022	.9997	5
24.37	2.927	2.929	.047	.9998	6
33.35	2.925	2.928	.035	.9995	7
44.72	2.924	2.926	.023	.9997	8
59.45	2.92	2.923	-8E-03	.9997	9
76.09	2.926	2.93	.057	.9994	10
95.48	2.931	2.935	.114	.9999	11
118.38	2.934	2.939	.151	.9994	12
141.52	2.956	2.962	.379	.9994	13
171.75	2.961	2.968	.441	.9997	14
199.58	2.995	3.003	.786	.9998	15
224.07	3.04	3.049	1.247	.9998	16
255.5	3.065	3.075	1.506	.9998	17
282.32	3.115	3.126	2.019	.9992	18
302.7	3.172	3.183	2.588	.9999	19
330.03	3.209	3.221	2.975	.9999	20
355.86	3.255	3.268	3.44	.9998	21
374.59	3.308	3.321	3.972	.9996	22
393.31	3.373	3.387	4.631	1	23
410.61	3.424	3.438	5.14	.9997	24
420.74	3.501	3.515	5.915	.9999	25

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J25
1	5.615	0	
2	8.484	.035	
3	12.024	.079	
4	15.381	.126	
5	18.677	.177	
6	21.973	.232	
7	25.024	.294	
8	27.893	.363	
9	30.396	.441	
10	32.471	.533	
11	34.119	.635	
12	35.461	.747	
13	36.438	.874	
14	37.17	1.008	
15	37.048	1.169	
16	36.56	1.338	
17	36.499	1.5	
18	35.339	1.685	
19	34.485	1.876	
20	33.63	2.046	
21	32.41	2.236	
22	30.64	2.439	
23	29.602	2.623	
24	27.527	2.839	
25	26.306	3.033	
26	24.475	3.252	

	J(KN/M)	T	W	J25
1	129.95	92.18	16.58	
2	156.64	444.55	66.13	
3	185.66	73.43	9.07	
4	211.82	48.44	5.13	
5	239.79	110.59	10.21	
6	268.91	47.55	3.81	
7	292.51	32.62	2.34	
8	316.36	64.36	4.17	
9	342.94	50.55	2.95	
10	365.23	32.08	1.71	
11	383.95	25.87	1.26	
12	401.96	30.97	1.4	
13	415.67	11.91	.5	


SPECIMEN J26(RT)
SLOPE 201
INTERCEPT 326
J1C 421
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J26 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J26
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

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      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J26
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                HAZ(PN-107)
 TEST TEMPERATURE(DEG C)                           20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         347.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       547.2
 CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
 SPECIMEN THICKNESS B(CM)                          2.537
 PERCENT SIDE GROOVE                               20.969
 SPECIMEN WIDTH W(CM)                              5.082
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.92346E+11
 EFFECTIVE MODULUS(Pa)                             2.14520081E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          21.39
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               2.925

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.013
 INITIAL A/W                                       .576
 AVERAGE CRACK EXTENSION 9PT(CM)                   .273
 DELTA A(CM) COMPLIANCE                            .277
 MAX DEVIATION OF SINGLE MEASUREMENT %             3.2

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    19
 LAST POINT                     28
 JIC(KN/M)                      421
 CORRELATION COEFF              .95
 SLOPE M(MPa)                   201
 INTERCEPT B (KN/M)             326

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       NO
 LIGAMENT>25JIC/EFFECTIVE YIELD NO
 DJ/DA<EFFECTIVE YIELD          YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          YES
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   448.57
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 420.59
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.157
 25*JQ/EF.Y.(CM)                                   2.352

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      19
 LAST DATA POINT USED     30
 CONSTANT(C1)             527.56
 EXPONENT(C2)             .4569
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            J26(RT)

 K          J-ELASTIC      J-PLASTIC     JEL+JPL       J(M)        J(TO.AREA)  CR. LN
 (MPaRTM)   (KN/M)         (KN/M)        (KN/M)      (KN/M)          (KN/M)          (CM)

 21.35      2.16           .03           2.18         2.18          2.31      2.924   1
 31.94      4.83           .23           5.05         5.05          5.35      2.917   2
 42.68      8.62           .36           8.98         8.98          9.48      2.928   3
 52.76      13.17          1.63          14.8         14.8          15.57     2.93    4
 62.02      18.2           4.71          22.9         22.89         23.99     2.919   5
 70.35      23.42          11.41         34.82        34.82         36.21     2.919   6
 76.7       27.83          23.65         51.49        51.49         53.12     2.921   7
 81.06      31.09          42.58         73.67        73.76         75.47     2.927   8
 83.88      33.29          66.37         99.66        99.6          101.62    2.921   9
 86.94      35.76          91.72         127.48       127.68        129.54    2.927   10
 89.67      38.04          117.94        155.98       156.6         158.13    2.935   11
 92.14      40.17          146.61        186.77       187.78        189       2.94    12
 93.78      41.6           178.32        219.93       220.9         222.25    2.94    13
 95.75      43.38          209.31        252.69       254.64        255.04    2.949   14
 97.34      44.83          243.72        288.55       291.46        290.93    2.956   15
 99.27      46.62          276.3         322.92       327.6         325.3     2.968   16
 100.48     47.76          312.07        359.83       365.18        362.25    2.972   17
 101.65     48.88          348.81        397.69       404.47        400.11    2.979   18
 103.24     50.43          383.3         433.73       443.71        436.11    2.994   19
 104.76     51.93          417.67        469.6        483.3         471.93    3.009   20
 105.47     52.63          455.44        508.07       524.11        510.36    3.018   21
 106.44     53.6           492.11        545.71       565.8         547.93    3.032   22
 106.79     53.95          531.13        585.08       608.38        587.22    3.042   23
 107.62     54.8           567.87        622.66       650.74        624.72    3.056   24
 108.55     55.75          602.33        658.08       693.78        660.01    3.077   25
 109.03     56.24          636.98        693.23       737.28        694.99    3.099   26
 108.54     55.73          672.64        728.37       783.26        729.85    3.125   27
 110.37     57.63          697.79        755.43       825.64        756.81    3.159   28
 109.33     56.55          735.87        792.41       871.21        793.52    3.177   29
 109.74     56.98          766.71        823.69       914.7         824.61    3.202   30

 H(M)           D(M)            POISSON'S RATIO
 .01906         2.54E-03        .3
```

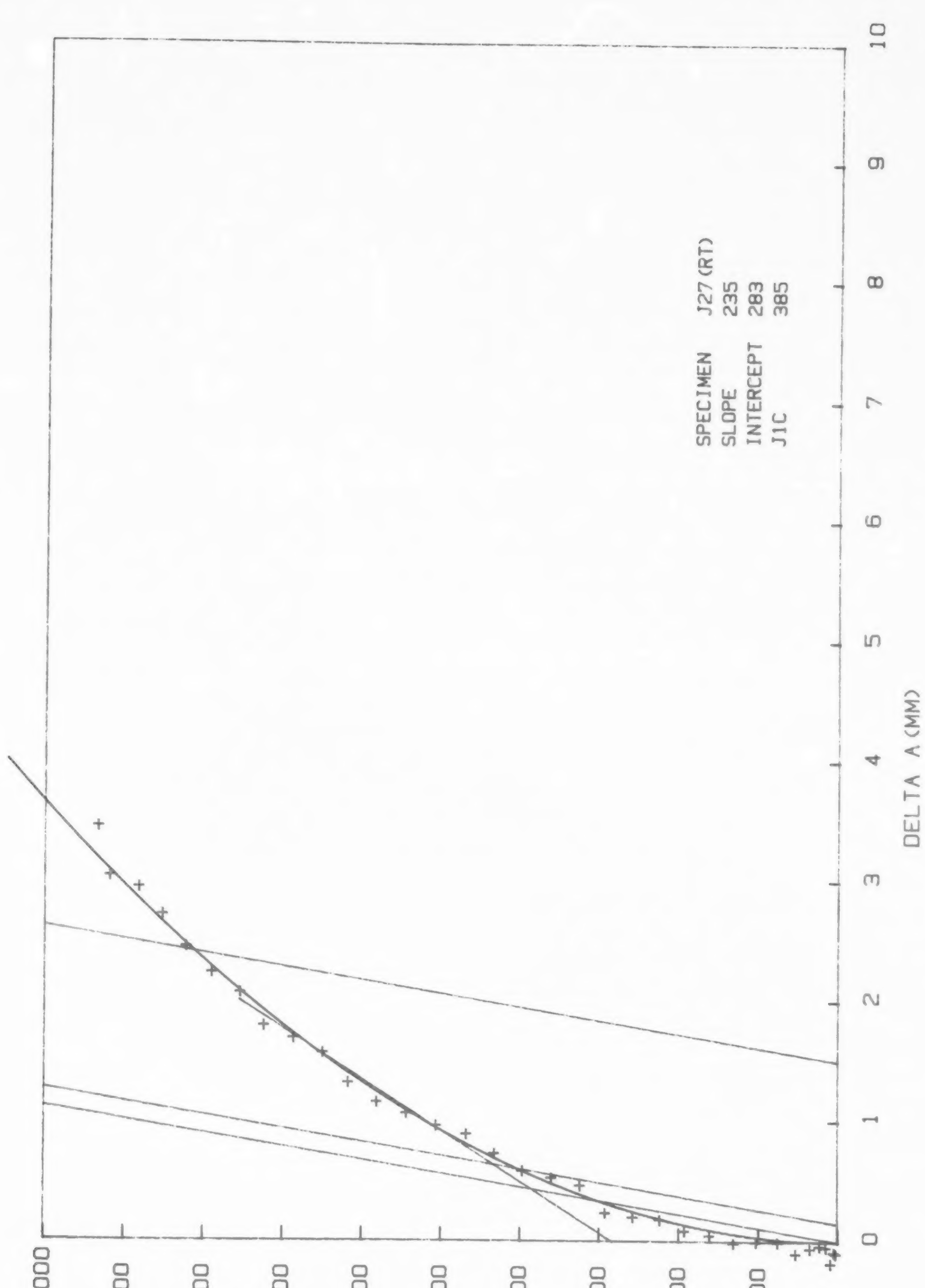
J26

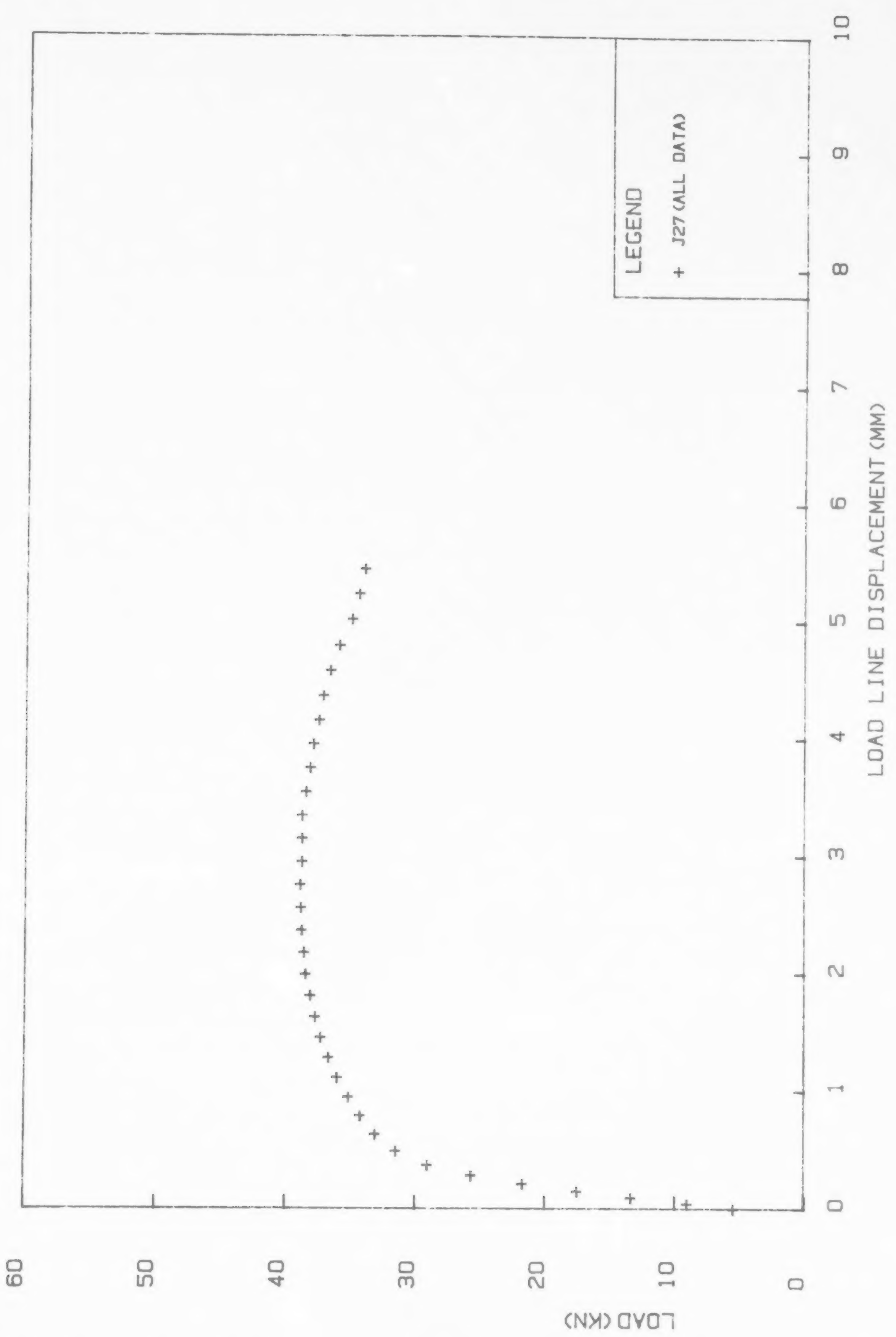
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.18	2.923	2.924	-.012	.9997	1
5.05	2.916	2.917	-.08	.9998	2
8.98	2.928	2.928	.034	.9999	3
14.8	2.928	2.93	.046	.9999	4
22.9	2.917	2.919	-.063	.9998	5
34.82	2.917	2.919	-.061	.9999	6
51.49	2.918	2.921	-.043	.9999	7
73.67	2.923	2.927	.015	.9999	8
99.66	2.916	2.921	-.038	1	9
127.48	2.921	2.927	.023	.9998	10
155.98	2.928	2.935	.097	.9999	11
186.77	2.932	2.94	.152	.9999	12
219.93	2.931	2.94	.148	.9995	13
252.69	2.939	2.949	.237	.9999	14
288.55	2.945	2.956	.311	.9999	15
322.92	2.955	2.968	.428	.9999	16
359.83	2.958	2.972	.466	.9999	17
397.69	2.964	2.979	.54	.9999	18
433.73	2.978	2.994	.687	.9998	19
469.6	2.992	3.009	.841	.9998	20
508.07	3	3.018	.93	.9999	21
545.71	3.013	3.032	1.07	.9999	22
585.08	3.022	3.042	1.172	.9999	23
622.66	3.034	3.056	1.313	.9999	24
658.08	3.054	3.077	1.522	.9999	25
693.23	3.075	3.099	1.736	.9999	26
728.37	3.099	3.125	1.996	.9999	27
755.43	3.133	3.159	2.341	.9998	28
792.41	3.15	3.177	2.524	.9999	29
823.69	3.174	3.202	2.771	.9999	30

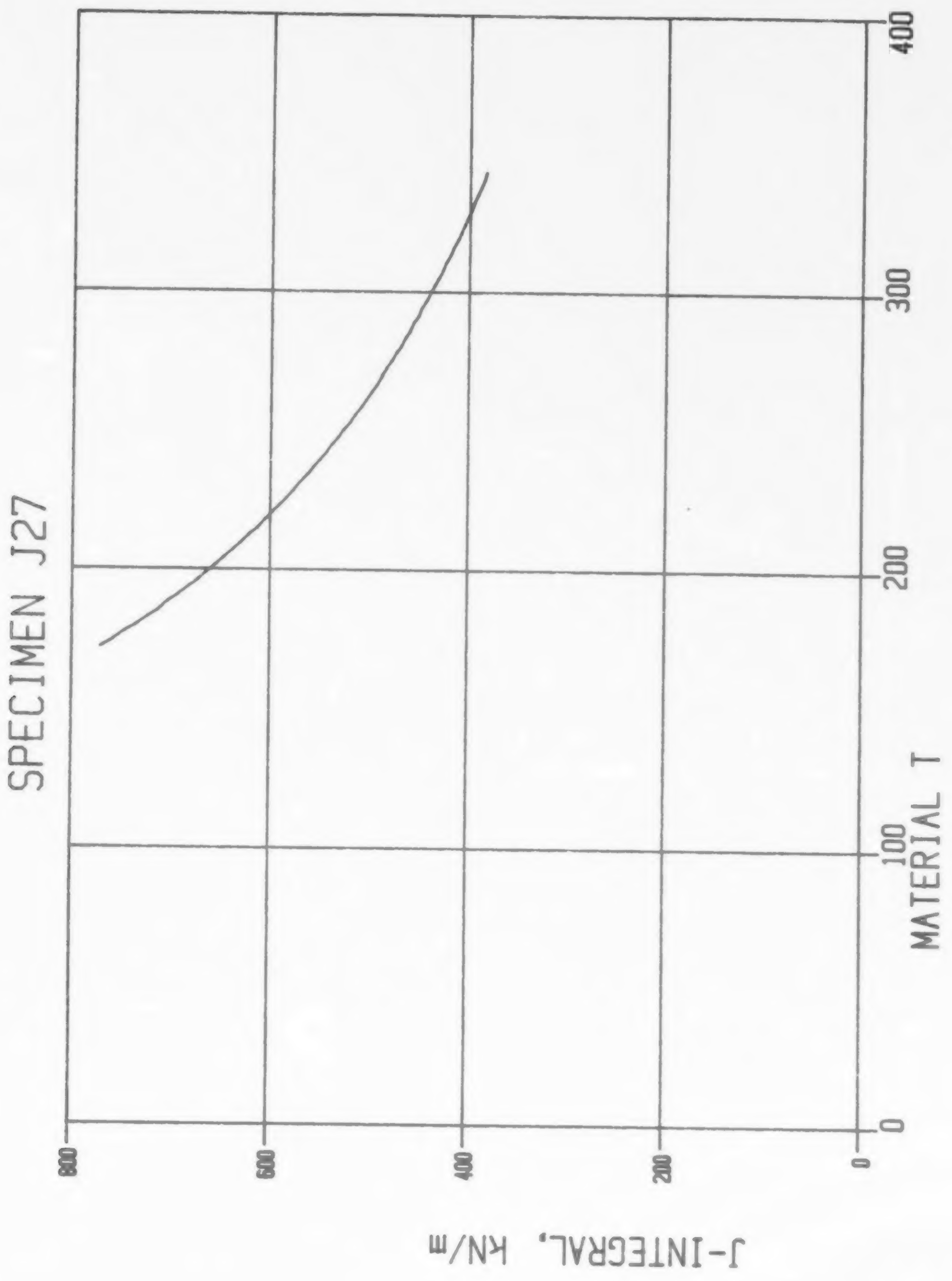
J26

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	5.066	0
2	8.728	.044
3	13.123	.098
4	17.395	.151
5	21.484	.212
6	25.452	.281
7	28.87	.369
8	31.433	.479
9	33.081	.615
10	34.363	.764
11	35.461	.923
12	36.377	1.082
13	37.231	1.248
14	37.903	1.418
15	38.452	1.592
16	38.879	1.777
17	39.307	1.958
18	39.673	2.141
19	39.917	2.332
20	40.1	2.522
21	40.222	2.712
22	40.222	2.905
23	40.161	3.103
24	39.978	3.303
25	39.856	3.503
26	39.551	3.708
27	39.063	3.916
28	38.086	4.138
29	37.659	4.348
30	36.743	4.568
31	36.133	4.783

	J(KN/M)	T	W	J26
1	415.71	235.77	12.33	
2	451.66	223.15	10.66	
3	488.83	416.9	18.32	
4	526.89	257.99	10.45	
5	565.39	369.26	13.87	
6	603.87	256.96	8.97	
7	640.37	162.96	5.31	
8	675.65	157.84	4.82	
9	710.8	129.73	3.72	
10	741.9	75.35	2.03	
11	773.92	193.62	4.96	
12	808.05	122.11	2.96	


SPECIMEN J27 (RT)
SLOPE 235
INTERCEPT 283
J1C 385
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J27 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J27
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

SPECIMEN NUMBER                                J27
MATERIAL TYPE                                  A106B
MATERIAL CONDITION                             HAZ(PN107)
TEST TEMPERATURE(DEG C)                        20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)      347.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)    547.2
CRACK PLANE ORIENTATION (PER ASTM E399)        L-C
SPECIMEN THICKNESS B(CM)                       2.54
PERCENT SIDE GROOVE                            20.59
SPECIMEN WIDTH W(CM)                           5.082
YOUNGS MODULUS AT TEST TEMP(Pa)                1.92346E+11
EFFECTIVE MODULUS(Pa)                          2.14619824E+11

               FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN          10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM       21.62
INITIAL CRACK LENGTH-COMPLIANCE(CM)            2.942

               CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                 3.022
INITIAL A/W                                    .579
AVERAGE CRACK EXTENSION 9PT(CM)                .353
DELTA A(CM) COMPLIANCE                         .345
MAX DEVIATION OF SINGLE MEASUREMENT %          3.72

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                    19
LAST POINT                     29
JIC(KN/M)                      385
CORRELATION COEFF              .97
SLOPE M(MPa)                   235
INTERCEPT B (KN/M)             283

               VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD       NO
LIGAMENT>25JIC/EFFECTIVE YIELD NO
DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                       NO
CRACK SIZE DA<0.15*DELTA A                     YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                451.25
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M              401.67
DELTA A(MAX) ALLOWED(MM)(0.1*b0)               2.14
25*JQ/EF.Y.(CM)                                2.151

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED      19
LAST DATA POINT USED     34
CONSTANT(C1)             521.42
EXPONENT(C2)             .5036
```

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          J27(RT)

K           J-ELASTIC     J-PLASTIC    JEL+JPL     J(M)       J(TO.AREA)  CR.   LN
(MPaRTM)    (KN/M)        (KN/M)       (KN/M)      (KN/M)       (KN/M)          (CM)

22.15       2.32          .04          2.36        2.36         2.52     2.933  1
32.81       5.09          .05          5.14        5.14         5.46     2.934  2
42.7        8.63          .6           9.23        9.23         9.76     2.924  3
53.49       13.53         1.67         15.2        15.2         15.99    2.938  4
63.31       18.96         4.53         23.49       23.49        24.59    2.939  5
71.46       24.16         11.43        35.59       35.59        37       2.937  6
77.22       28.21         25.48        53.69       53.66        55.35    2.932  7
81.69       31.57         44.93        76.5        76.62        78.3     2.942  8
84.55       33.82         69.59        103.41      103.53       105.34   2.942  9
86.75       35.6          96.09        131.7       131.78       133.74   2.941  10
89.25       37.69         123.69       161.38      161.82       163.49   2.947  11
91.17       39.32         153.55       192.87      193.6        195.06   2.951  12
93.32       41.2          182.96       224.16      225.76       226.37   2.96   13
94.52       42.27         215.69       257.96      259.79       260.23   2.962  14
95.7        43.33         249.45       292.78      295.1        295.07   2.966  15
98.25       45.67         278.91       324.57      330.39       326.82   2.988  16
99.03       46.39         314.23       360.63      367.55       362.86   2.995  17
99.94       47.25         350.1        397.36      405.46       399.59   3.001  18
101.18      48.44         384.48       432.91      444.16       435.08   3.015  19
102.6       49.8          418.56       468.36      483.56       470.47   3.031  20
102.83      50.03         456.62       506.64      523.72       508.69   3.038  21
103.63      50.81         493.44       544.25      564.26       546.25   3.048  22
104.38      51.54         529.99       581.54      604.5        583.49   3.057  23
104.85      52.02         565.5        617.52      645.94       619.34   3.073  24
106.08      53.24         596.53       649.77      687.29       651.46   3.098  25
106.42      53.58         633.21       686.79      729.06       688.39   3.111  26
106.1       53.26         670.99       724.25      770.83       725.71   3.121  27
107.61      54.78         699.23       754.01      812.77       755.36   3.148  28
107.48      54.66         735.27       789.92      856.51       791.09   3.165  29
107.4       54.57         767.87       822.44      899.57       823.4    3.187  30
106.85      54.02         798.17       852.19      943.24       852.89   3.213  31
107.22      54.39         827.92       882.31      985.73       882.83   3.236  32
106.74      53.9          865.35       919.25      1027.97      919.63   3.245  33
109.27      56.49         877.43       933.92      1067.52      934.38   3.287  34

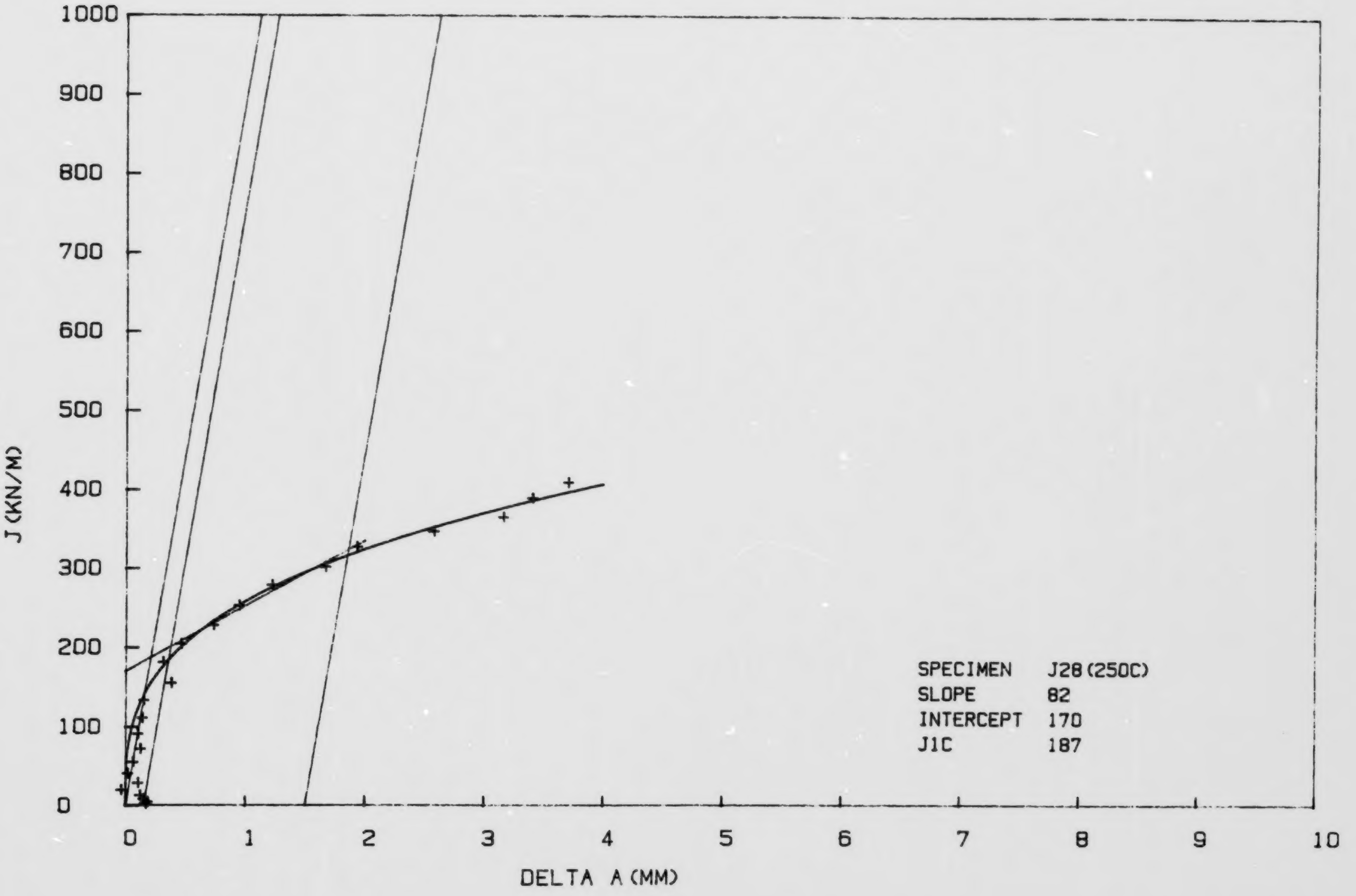
H(M)              D(M)            POISSON'S RATIO
.01902            2.54E-03        .3
```

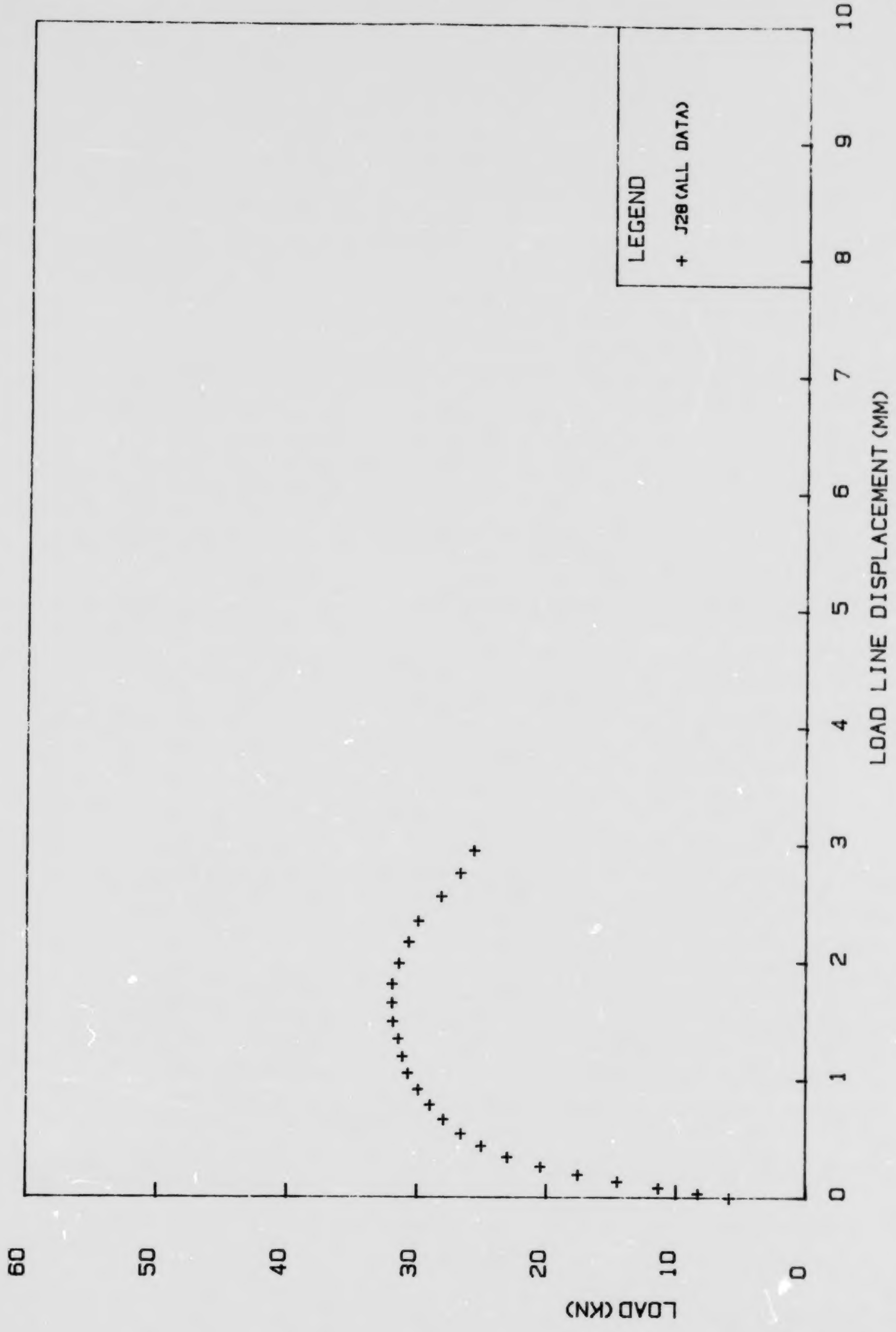
J27

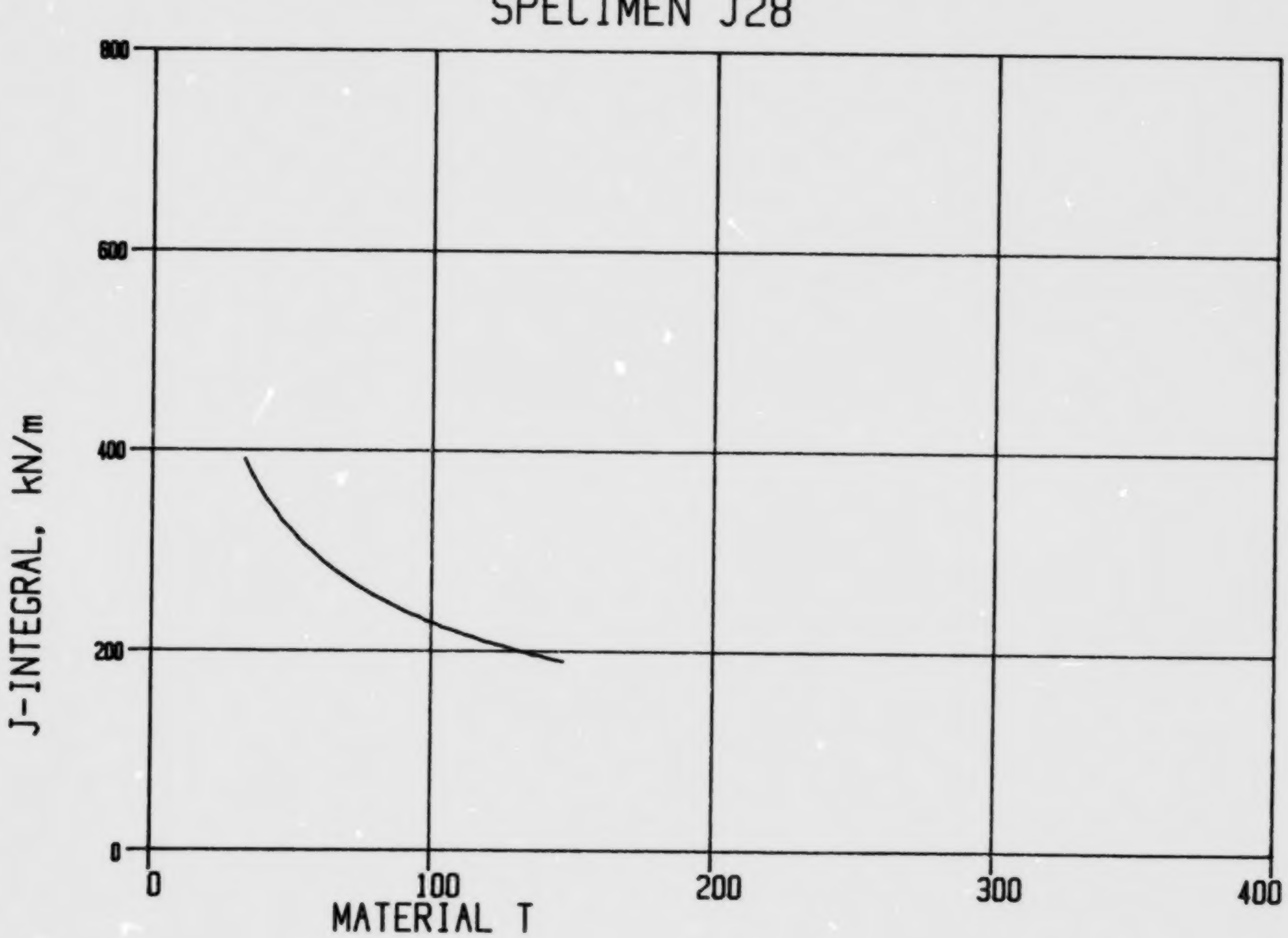
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.36	2.932	2.933	-.093	.9998	1
5.14	2.933	2.934	-.082	.9999	2
9.23	2.923	2.924	-.178	.9998	3
15.2	2.936	2.938	-.043	.9999	4
23.49	2.937	2.939	-.031	.9999	5
35.59	2.934	2.937	-.053	.9998	6
53.69	2.929	2.932	-.097	.9999	7
76.5	2.938	2.942	0	.9998	8
103.41	2.937	2.942	0	.9999	9
131.7	2.935	2.941	-.01	.9997	10
161.38	2.94	2.947	.051	.9999	11
192.87	2.943	2.951	.088	.9998	12
224.16	2.951	2.96	.181	.9999	13
257.96	2.952	2.962	.201	.9996	14
292.78	2.954	2.966	.237	.9998	15
324.57	2.976	2.988	.463	.9995	16
360.63	2.981	2.995	.526	.9997	17
397.36	2.986	3.001	.586	.9997	18
432.91	2.999	3.015	.728	.9999	19
468.36	3.014	3.031	.89	.9998	20
506.64	3.02	3.038	.961	.9999	21
544.25	3.029	3.048	1.061	.9998	22
581.54	3.037	3.057	1.155	.9999	23
617.52	3.052	3.073	1.315	.9999	24
649.77	3.075	3.098	1.564	.9993	25
686.79	3.086	3.111	1.685	.9999	26
724.25	3.096	3.121	1.789	.9998	27
754.01	3.122	3.148	2.064	.9997	28
789.92	3.138	3.165	2.232	.9996	29
822.44	3.158	3.187	2.446	.9999	30
852.19	3.184	3.213	2.713	.9998	31
882.31	3.206	3.236	2.94	.9998	32
919.25	3.214	3.245	3.032	.9997	33
933.92	3.255	3.287	3.446	.9954	34

```
               LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J27
     1          5.432         0
     2          9.033         .044
     3          13.367        .095
     4          17.517        .149
     5          21.729        .212
     6          25.696        .283
     7          29.053        .371
     8          31.494        .488
     9          33.081        .63
     10         34.241        .786
     11         35.156        .945
     12         36.011        1.111
     13         36.682        1.282
     14         37.292        1.453
     15         37.72         1.628
     16         38.086        1.809
     17         38.452        1.992
     18         38.574        2.178
     19         38.757        2.366
     20         38.818        2.559
     21         38.879        2.754
     22         38.757        2.949
     23         38.757        3.147
     24         38.757        3.342
     25         38.452        3.545
     26         38.147        3.75
     27         37.903        3.953
     28         37.476        4.155
     29         37.17         4.365
     30         36.621        4.58
     31         35.95         4.795
     32         34.973        5.017
     33         34.424        5.234
     34         33.997        5.447
     35         33.569        5.659
```

	J(KN/M)	T	W	J27
1	378.99	592.25	33.86	
2	415.13	239.02	12.39	
3	450.64	210.31	9.96	
4	487.5	522.07	22.78	
5	525.45	359.15	14.47	
6	562.89	383.57	14.36	
7	599.53	215.93	7.53	
8	633.64	124.61	4.06	
9	668.28	292.67	8.99	
10	705.52	347.19	10.05	
11	739.13	103.85	2.83	
12	771.97	205.5	5.31	
13	806.18	146.11	3.58	
14	837.31	106.83	2.48	
15	867.25	127.8	2.83	
16	900.78	382.81	8.13	
17	926.58	34.05	.69	


1000
900
800
700
600
500
400
300
200
100
0
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J28 (250C)
SLOPE 82
INTERCEPT 170
J1C 187


LEGEND
+ J28 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J28
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                     J28
 MATERIAL TYPE                                       A106B
 MATERIAL CONDITION                                  HAZ(PN107)
 TEST TEMPERATURE(DEG C)                             250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           353.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         542.3
 CRACK PLANE ORIENTATION (PER ASTM E399)             L-C
 SPECIMEN THICKNESS B(CM)                            2.538
 PERCENT SIDE GROOVE                                 20.961
 SPECIMEN WIDTH W(CM)                                5.084
 YOUNGS MODULUS AT TEST TEMP(Pa)                     1.82776E+11
 EFFECTIVE MODULUS(Pa)                               1.99740974E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN               10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            22.98
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                 3.025

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                      3.11
 INITIAL A/W                                         .595
 AVERAGE CRACK EXTENSION 9PT(CM)                     .425
 DELTA A(CM) COMPLIANCE                              .37
 MAX DEVIATION OF SINGLE MEASUREMENT %               2.6

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                      15
 LAST POINT                       19
 JIC(KN/M)                        187
 CORRELATION COEFF                .98
 SLOPE M(MPa)                     82
 INTERCEPT B (KN/M)               170

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD         YES
 LIGAMENT>25JIC/EFFECTIVE YIELD   YES
 DJ/DA<EFFECTIVE YIELD            YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                            YES
 CRACK SIZE DA<0.15*DELTA A                          YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     449.34
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   378.23
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.059
 25*JQ/EF.Y.(CM)                                     1.044

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED         15
 LAST DATA POINT USED        24
 CONSTANT(C1)                258.45
 EXPONENT(C2)                .3283
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J28(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.14	2.44	.05	2.49	2.49	2.61	3.042	1
30.31	4.57	.3	4.87	4.87	5.13	3.044	2
38.69	7.45	.91	8.36	8.36	8.81	3.04	3
46.71	10.86	2.37	13.23	13.23	13.91	3.037	4
53.68	14.34	5.71	20.05	20.03	20.99	3.022	5
61.06	18.56	10.48	29.04	29.07	30.22	3.036	6
65.97	21.67	19.36	41.03	40.99	42.44	3.027	7
70.4	24.67	30.87	55.54	55.57	57.13	3.032	8
74.3	27.49	44.95	72.44	72.58	74.18	3.038	9
76.92	29.46	61.87	91.33	91.41	93.22	3.036	10
79.58	31.53	80.11	111.64	111.86	113.64	3.039	11
81.76	33.28	100.47	133.75	134.04	135.86	3.04	12
84.37	35.44	119.97	155.42	157.17	157.53	3.063	13
84.75	35.76	145.75	181.52	182.74	183.7	3.056	14
86.93	37.62	167.2	204.82	207.47	207.04	3.072	15
88.94	39.38	188.9	228.28	233.82	230.44	3.098	16
90.47	40.75	212.42	253.17	261.36	255.27	3.12	17
90.92	41.16	237.86	279.02	291.07	280.93	3.147	18
92.12	42.25	259.63	301.88	321	303.56	3.192	19
91.96	42.1	285.36	327.47	351.27	328.92	3.219	20
91.45	41.64	305.73	347.37	383.73	348.37	3.283	21
91.33	41.53	323.71	365.24	414.14	365.88	3.341	22
89.78	40.13	349.42	389.55	444.2	389.88	3.366	23
89.9	40.24	369.2	409.44	471.73	409.59	3.395	24

H(M)	D(M)	POISSON'S RATIO
.01906	2.54E-03	.3

J28

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.49	3.042	3.042	.171	.9994	1
4.87	3.043	3.044	.187	1	2
8.36	3.04	3.04	.155	.9999	3
13.23	3.036	3.037	.124	.9998	4
20.05	3.02	3.022	-.035	.9999	5
29.04	3.034	3.036	.106	.9998	6
41.03	3.024	3.027	.02	.9999	7
55.54	3.028	3.032	.066	.9999	8
72.44	3.034	3.038	.128	.9999	9
91.33	3.031	3.036	.105	.9997	10
111.64	3.034	3.039	.142	.9999	11
133.75	3.034	3.04	.154	.9999	12
155.42	3.056	3.063	.382	.9999	13
181.52	3.048	3.056	.314	.9999	14
204.82	3.063	3.072	.466	.9999	15
228.28	3.089	3.098	.733	1	16
253.17	3.109	3.12	.948	.9999	17
279.02	3.136	3.147	1.224	.9999	18
301.88	3.18	3.192	1.67	.9997	19
327.47	3.206	3.219	1.937	.9998	20
347.37	3.27	3.283	2.578	.9988	21
365.24	3.327	3.341	3.161	.9998	22
389.55	3.351	3.366	3.406	.9996	23
409.44	3.38	3.395	3.705	.9995	24

```
              LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J28
  1            5.859         0
  2            8.301          .037
  3           11.353          .084
  4           14.526          .137
  5           17.578          .195
  6           20.447          .262
  7           23.01           .344
  8           25.024          .437
  9           26.611          .544
  10          27.954          .663
  11          28.992          .786
  12          29.907          .917
  13          30.701         1.053
  14          31.128         1.198
  15          31.433         1.346
  16          31.86          1.494
  17          31.921         1.652
  18          31.921         1.813
  19          31.372         1.987
  20          30.64          2.169
  21          29.907         2.349
  22          28.137         2.557
  23          26.672         2.758
  24          25.635         2.948
  25          24.963         3.129
```

```
        J(KN/M)               T            W      J28

1           193.17       139.33           15.94
2           216.55       79.98            8.05
3           240.73       105.68           9.47
4           266.09       85.16            6.81
5           290.45       46.68            3.34
6           314.67       87.52            5.7
7           337.42       28.24            1.66
8           356.3        27.94            1.5
9           377.39       90.26            4.51
10          399.5        60.64            2.81
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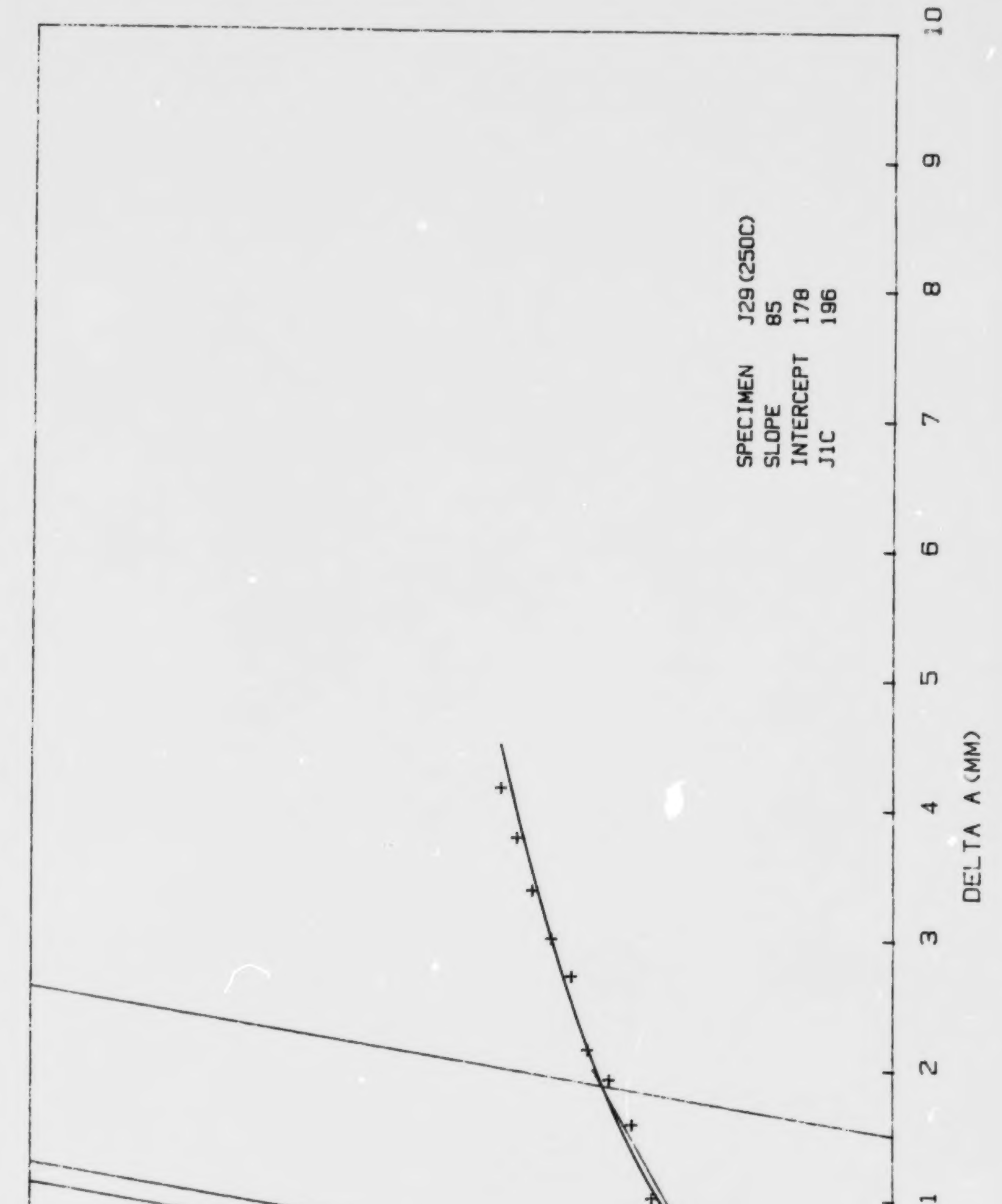
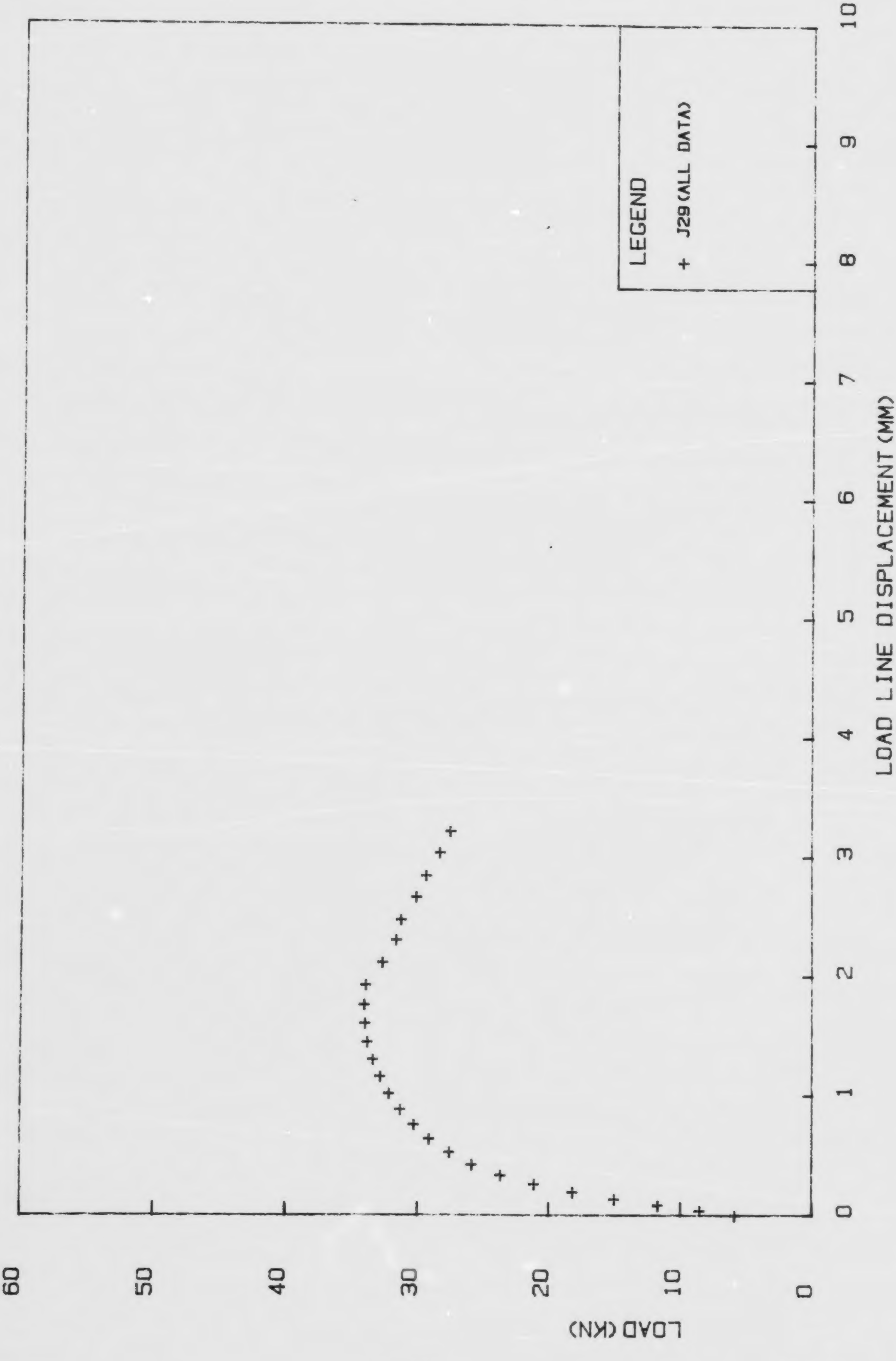
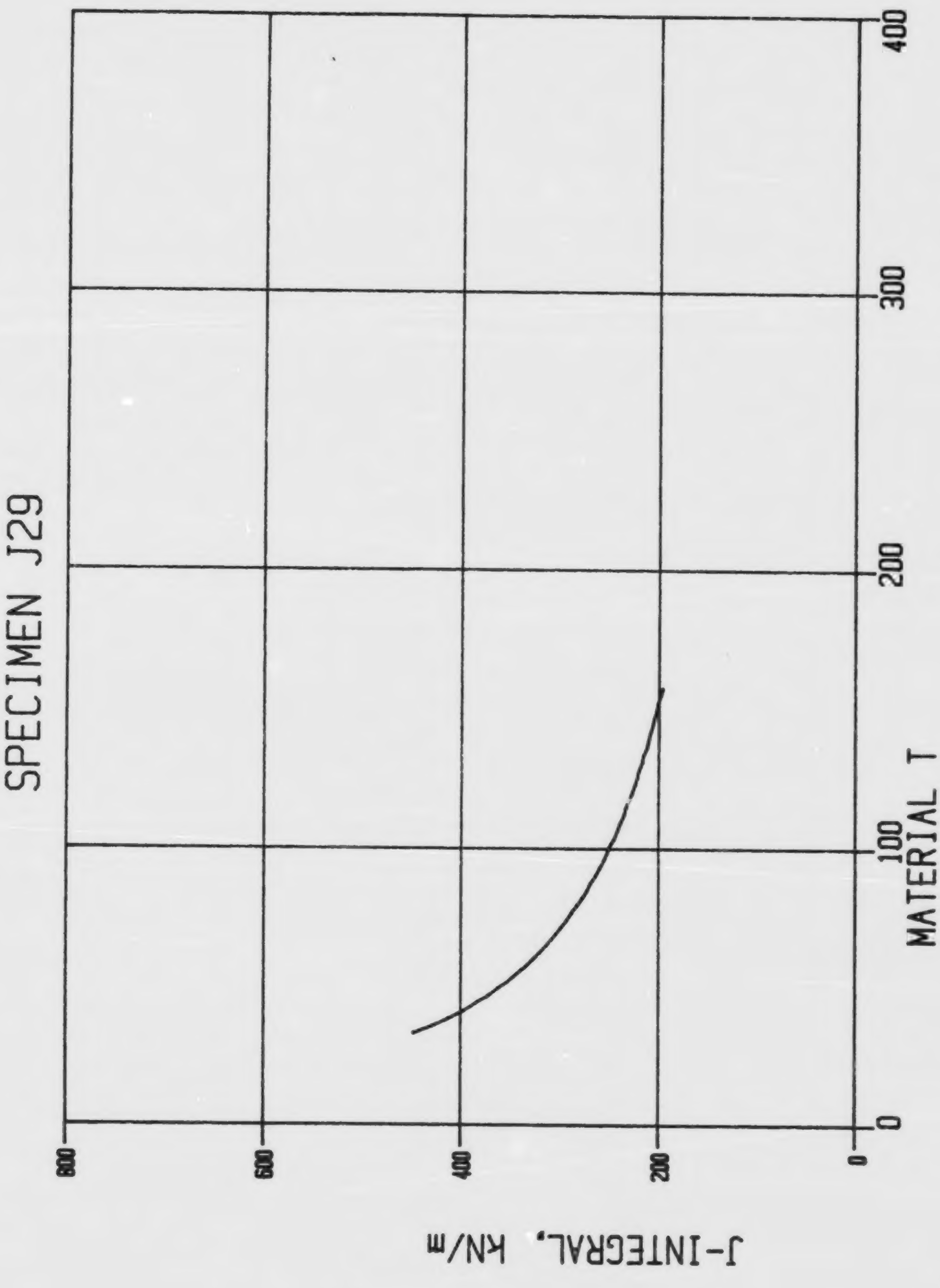

SPECIMEN J29(250C)
SLOPE 85
INTERCEPT 178
J1C 196
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J29 (ALL DATA)


SPECIMEN J29
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

SPECIMEN NUMBER                                    J29
MATERIAL TYPE                                      A106B
MATERIAL CONDITION                                 HAZ(PN107)
TEST TEMPERATURE(DEG C)                            250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          353.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        542.3
CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
SPECIMEN THICKNESS B(CM)                           2.54
PERCENT SIDE GROOVE                                20.984
SPECIMEN WIDTH W(CM)                               5.084
YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
EFFECTIVE MODULUS(Pa)                              2.01442597E+11

               FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN              10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           22.04
INITIAL CRACK LENGTH-COMPLIANCE(CM)                2.97

               CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                     3.047
INITIAL A/W                                        .584
AVERAGE CRACK EXTENSION 9PT(CM)                    .455
DELTA A(CM) COMPLIANCE                             .417
MAX DEVIATION OF SINGLE MEASUREMENT %              2

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                        15
LAST POINT                         19
JIC(KN/M)                          196
CORRELATION COEFF                  .9
SLOPE M(MPa)                       85
INTERCEPT B (KN/M)                 178

               VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD           YES
LIGAMENT>25JIC/EFFECTIVE YIELD     YES
DJ/DA<EFFECTIVE YIELD              YES

               QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                           YES
CRACK SIZE DA<0.15*DELTA A                         YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    449.57
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  380.24
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.114
25*JQ/EF.Y.(CM)                                    1.094

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED           15
LAST DATA POINT USED          26
CONSTANT(C1)                  271
EXPONENT(C2)                  .3463
```

J29(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
21.56	2.31	.1	2.41	2.41	2.56	2.97	1
29.81	4.42	.29	4.72	4.72	4.98	2.981	2
38.02	7.2	.97	8.17	8.17	8.61	2.974	3
46.05	10.56	2.49	13.05	13.05	13.7	2.974	4
54.1	14.57	4.84	19.41	19.43	20.28	2.99	5
59.99	17.92	10.31	28.23	28.21	29.35	2.975	6
65.62	21.44	18.1	39.54	39.53	40.88	2.976	7
69.84	24.29	29.51	53.8	53.76	55.32	2.974	8
73.59	26.97	43.41	70.38	70.3	72.07	2.972	9
77.22	29.69	58.46	88.15	88.4	89.96	2.984	10
79.51	31.47	77.11	108.59	108.62	110.54	2.978	11
82.34	33.75	96.2	129.95	130.5	131.99	2.989	12
84.25	35.34	118.47	153.81	154.54	155.93	2.992	13
86.42	37.18	140.19	177.37	178.98	179.54	3.004	14
88.05	38.6	163.77	202.38	204.7	204.59	3.012	15
90.01	40.33	186.62	226.95	231.53	229.14	3.034	16
90.99	41.22	212.6	253.82	259.8	255.99	3.045	17
92.52	42.62	236.72	279.34	288.89	281.43	3.072	18
93.1	43.15	259.43	302.58	320.76	304.33	3.128	19
92.7	42.78	286.26	329.04	353.12	330.5	3.162	20
93.37	43.41	310.6	354.01	382.48	355.35	3.185	21
94.3	44.28	328.77	373.05	413.38	374.14	3.242	22
94.34	44.31	352.42	396.73	443.63	397.61	3.271	23
94.03	44.02	375.01	419.03	475.07	419.64	3.308	24
94.8	44.74	392.34	437.09	503.94	437.53	3.348	25
95.19	45.11	410.74	455.85	533.64	456.1	3.387	26

H(M)	D(M)	POISSON'S RATIO
.01901	2.54E-03	.3

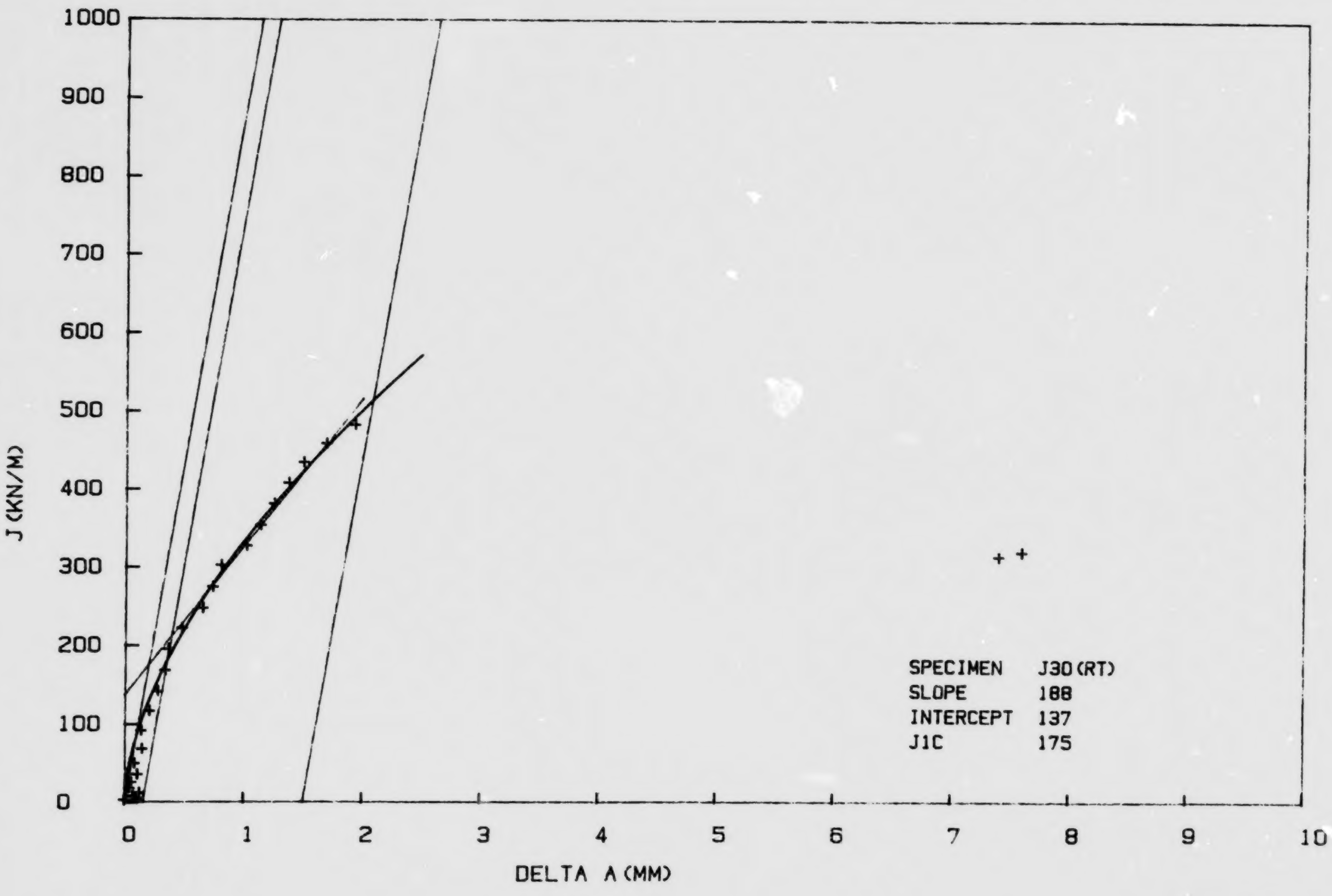
J29

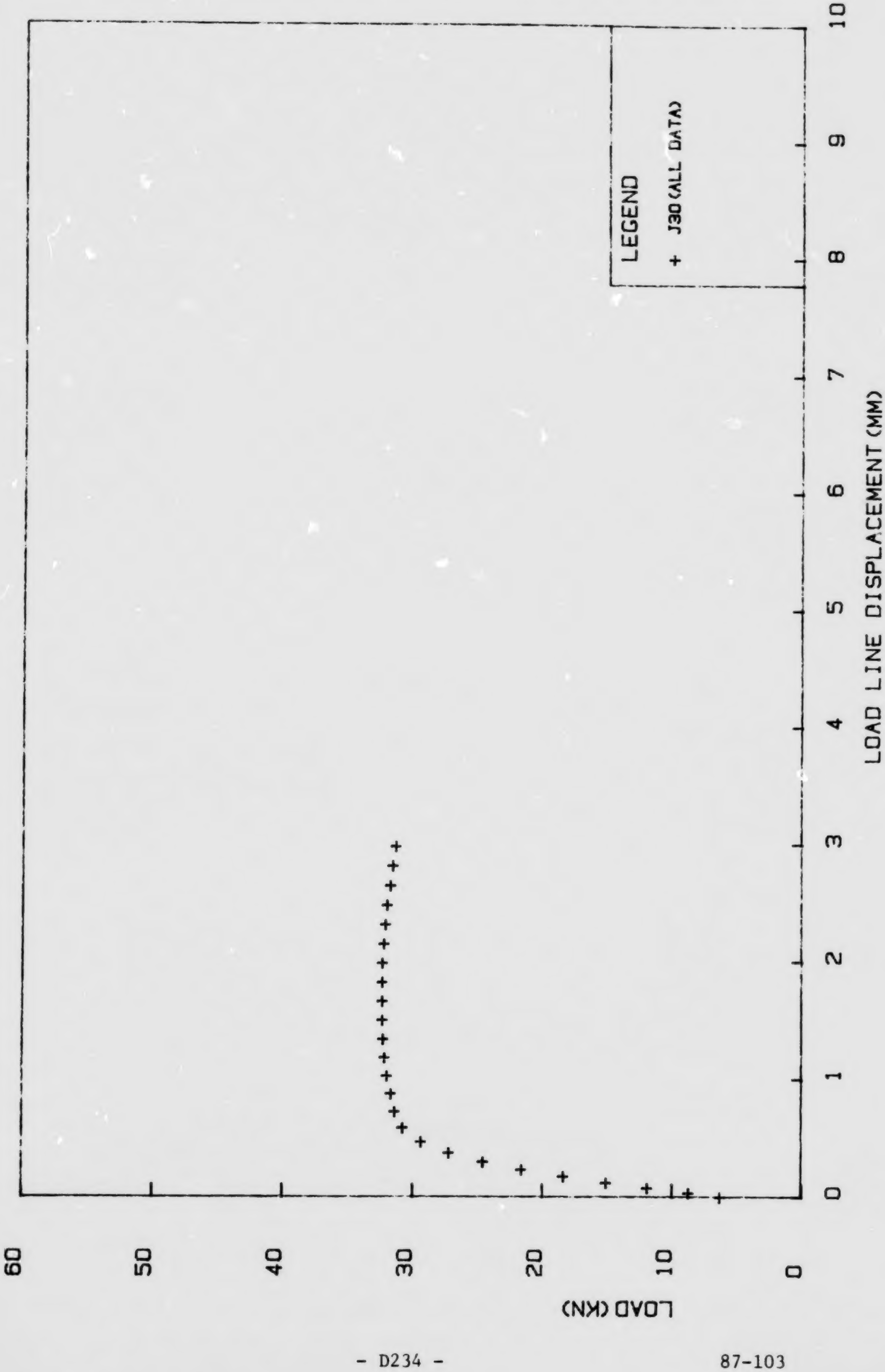
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.41	2.969	2.97	-4E-03	.9993	1
4.72	2.98	2.981	.105	.9998	2
8.17	2.973	2.974	.041	.9999	3
13.05	2.973	2.974	.041	.9999	4
19.41	2.988	2.99	.198	.9999	5
28.23	2.973	2.975	.049	.9997	6
39.54	2.974	2.976	.062	.9999	7
53.8	2.971	2.974	.04	.9998	8
70.38	2.968	2.972	.019	.9999	9
88.15	2.98	2.984	.142	.9998	10
108.59	2.973	2.978	.08	.9998	11
129.95	2.983	2.989	.189	.9998	12
153.81	2.985	2.992	.22	.9999	13
177.37	2.996	3.004	.337	.9998	14
202.38	3.003	3.012	.418	.9999	15
226.95	3.024	3.034	.635	.9999	16
253.82	3.035	3.045	.753	.9997	17
279.34	3.06	3.072	1.016	.9998	18
302.58	3.116	3.128	1.58	.9997	19
329.04	3.149	3.162	1.924	.9998	20
354.01	3.172	3.185	2.153	1	21
373.05	3.227	3.242	2.718	.9999	22
396.73	3.256	3.271	3.006	.9999	23
419.03	3.292	3.308	3.376	.9999	24
437.09	3.332	3.348	3.781	.9998	25
455.85	3.37	3.387	4.165	.9999	26

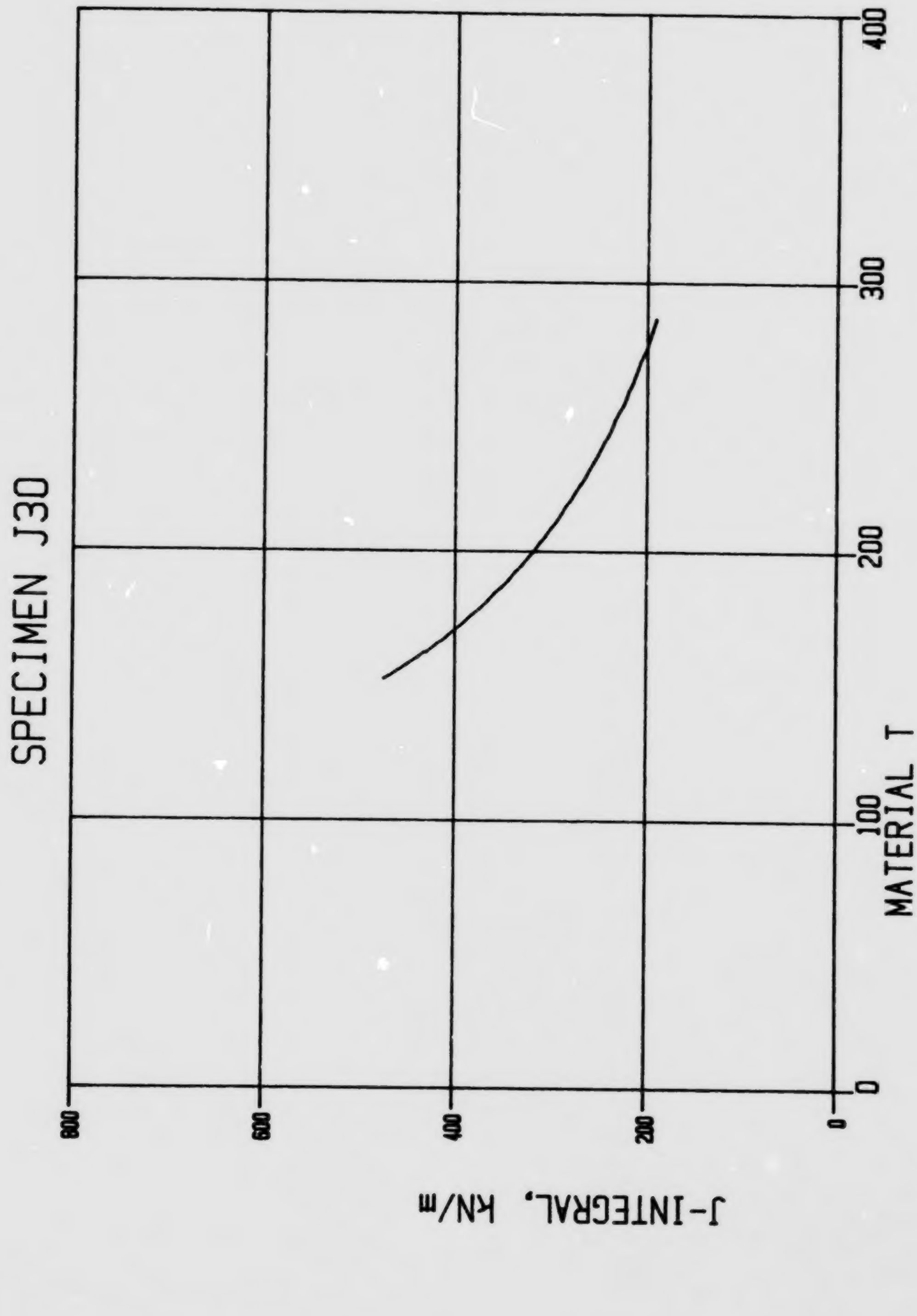
```
              LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J29
 1             5.859          0
 2             8.545          .039
 3             11.719         .085
 4             15.015         .137
 5             18.188         .195
 6             21.118         .261
 7             23.682         .336
 8             25.879         .425
 9             27.588         .527
 10            29.114         .64
 11            30.273         .759
 12            31.311         .884
 13            32.166         1.018
 14            32.837         1.16
 15            33.386         1.302
 16            33.813         1.449
 17            33.997         1.603
 18            34.058         1.76
 19            33.936         1.925
 20            32.654         2.114
 21            31.616         2.302
 22            31.25          2.472
 23            30.09          2.662
 24            29.358         2.842
 25            28.32          3.033
 26            27.527         3.214
 27            26.672         3.401
```

```
        J(KN/M)                   T                W      J29

 1          189.87        282.46          33.85
 2          214.66        102.82          10.78
 3          240.38        207.78          19.35
 4          266.58        88.49           7.34
 5          290.96        37.53           2.77
 6          315.81        69.94           4.67
 7          341.52        99.26           6.06
 8          363.53        30.7            1.71
 9          384.89        74.75           3.87
 10         407.88        54.88           2.62
 11         428.06        40.64           1.81
 12         446.47        44.48           1.86
```


1000
900
800
700
600
500
400
300
200
100
0
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J30 (RT)
SLOPE 188
INTERCEPT 137
J1C 175


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J30 (ALL DATA)


SPECIMEN J30
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J30
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   WELD(PN229)
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            367
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          516.1
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             2.54
 PERCENT SIDE GROOVE                                  20.826
 SPECIMEN WIDTH W(CM)                                 5.09500001
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.16643901E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             23.02
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.036

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.13
 INITIAL A/W                                          .596
 AVERAGE CRACK EXTENSION 9PT(CM)                      .207
 DELTA A(CM) COMPLIANCE                               .76
 MAX DEVIATION OF SINGLE MEASUREMENT %                2.5

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   15
 LAST POINT                    25
 JIC(KN/M)                     175
 CORRELATION COEFF             .98
 SLOPE M(MPa)                  188
 INTERCEPT B (KN/M)            137

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD      YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD         YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             YES
 CRACK SIZE DA<0.15*DELTA A                           NO
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      443.98
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    286.8
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.059
 25*JQ/EF.Y.(CM)                                      .991

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       15
 LAST DATA POINT USED      25
 CONSTANT(C1)              333.03
 EXPONENT(C2)              .5903
```

J30(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.99	2.5	.05	2.55	2.55	2.71	3.036	1
31.6	4.72	.01	4.74	4.74	5.03	3.047	2
39.92	7.54	.38	7.92	7.92	8.41	3.043	3
48.85	11.29	1.05	12.34	12.34	13.07	3.048	4
57.08	15.42	2.9	18.32	18.31	19.32	3.04	5
65.06	20.03	5.96	25.99	25.99	27.29	3.042	6
72.29	24.72	11.51	36.23	36.25	37.83	3.047	7
77.81	28.64	21.67	50.32	50.32	52.18	3.044	8
81.94	31.77	37.16	68.93	69.02	70.96	3.051	9
83.52	33	59.12	92.12	92.19	94.24	3.05	10
84.77	33.99	83.23	117.23	117.55	119.37	3.057	11
86.05	35.03	107.27	142.3	143.01	144.46	3.064	12
86.96	35.77	132.74	168.51	169.63	170.67	3.07	13
87.47	36.2	159.47	195.67	197.02	197.84	3.073	14
88.4	36.97	185.15	222.12	224.62	224.26	3.084	15
89.62	38	209.76	247.76	252.35	249.83	3.101	16
90.22	38.51	236.42	274.92	280.66	276.97	3.11	17
90.72	38.94	263.82	302.76	309.58	304.77	3.117	18
91.94	39.99	287.4	327.39	337.91	329.32	3.138	19
92.47	40.45	313.84	354.29	367.06	356.17	3.15	20
92.97	40.89	340.48	381.37	396.48	383.18	3.161	21
93.18	41.08	367.15	408.23	426.1	409.96	3.173	22
93.6	41.45	393.24	434.69	455.64	436.35	3.186	23
94.38	42.14	416.66	458.8	484.85	460.37	3.205	24
95.2	42.88	439.72	482.6	515.53	484.05	3.229	25
60.42	17.27	297.53	314.81	512.5	363.3	3.776	26
67.91	21.82	299.26	321.07	524.05	368.96	3.796	27

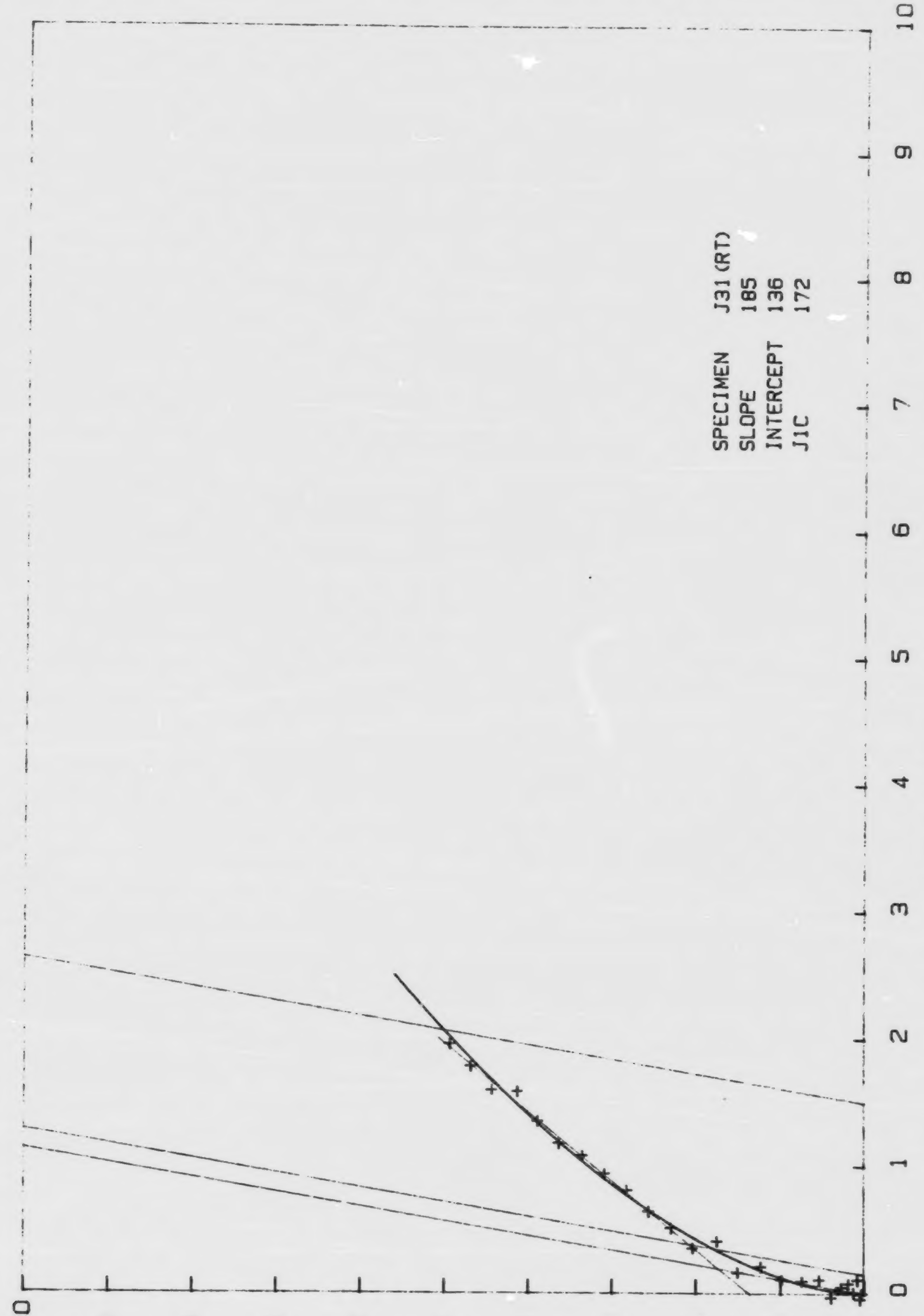
H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

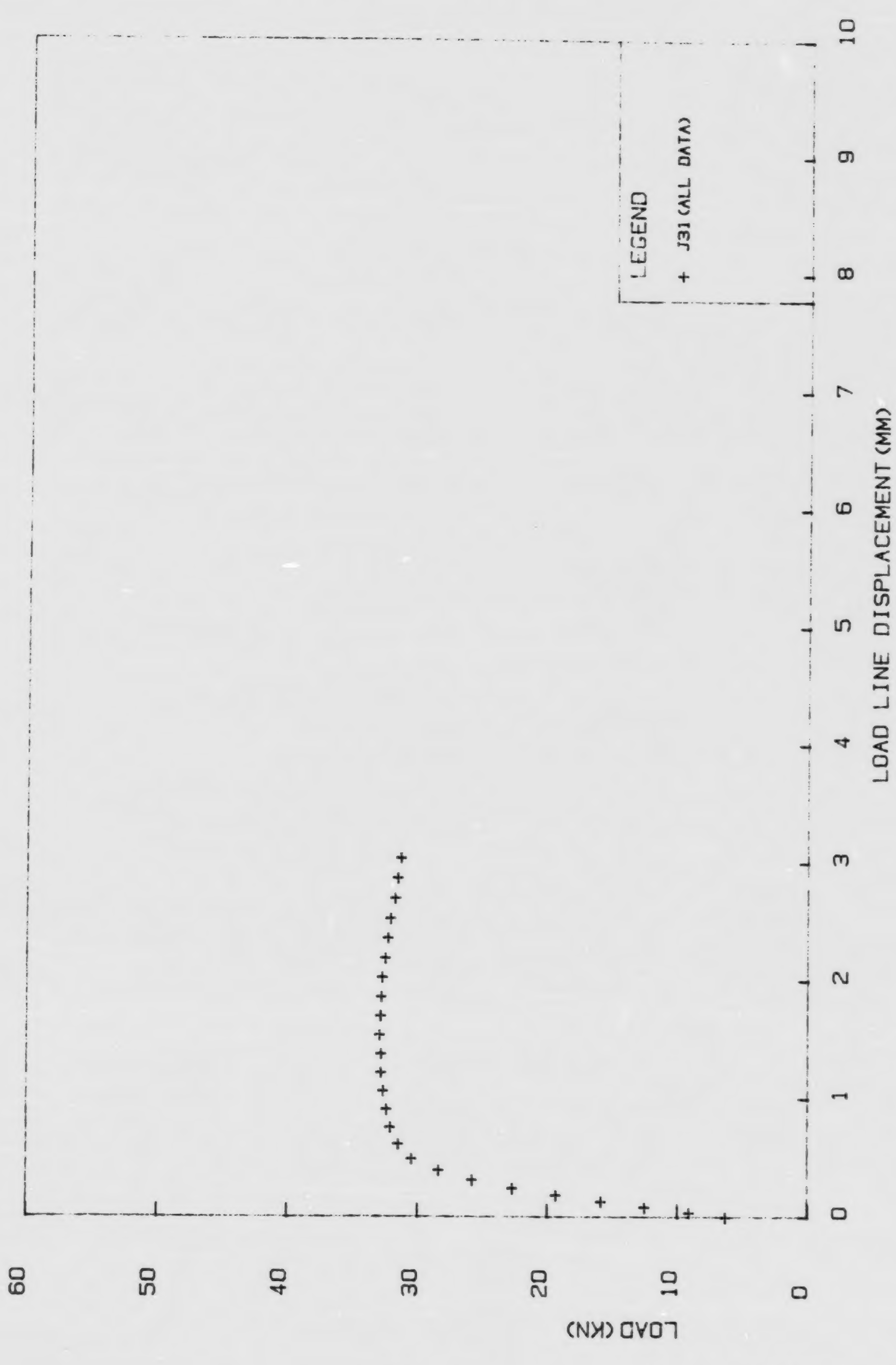
J30

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.55	3.036	3.036	-1E-03	.9996	1
4.74	3.046	3.047	.106	.9998	2
7.92	3.042	3.043	.07	.9996	3
12.34	3.047	3.048	.124	.9997	4
18.32	3.039	3.04	.041	.9998	5
25.99	3.04	3.042	.056	.9999	6
36.23	3.045	3.047	.108	.9999	7
50.32	3.042	3.044	.082	.9999	8
68.93	3.047	3.051	.148	.9999	9
92.12	3.046	3.05	.14	.9999	10
117.23	3.052	3.057	.207	.9994	11
142.3	3.058	3.064	.278	.9997	12
168.51	3.063	3.07	.339	.9997	13
195.67	3.065	3.073	.366	.9998	14
222.12	3.075	3.084	.478	.9998	15
247.76	3.092	3.101	.653	.9999	16
274.92	3.099	3.11	.737	.9998	17
302.76	3.105	3.117	.807	.9999	18
327.39	3.126	3.138	1.021	.9998	19
354.29	3.137	3.15	1.139	.9998	20
381.37	3.147	3.161	1.252	.9998	21
408.23	3.158	3.173	1.374	.9999	22
434.69	3.17	3.186	1.499	.9999	23
458.8	3.189	3.205	1.692	.9998	24
482.6	3.212	3.229	1.935	.9997	25
314.81	3.762	3.776	7.403	.9991	26
321.07	3.781	3.796	7.599	.9989	27

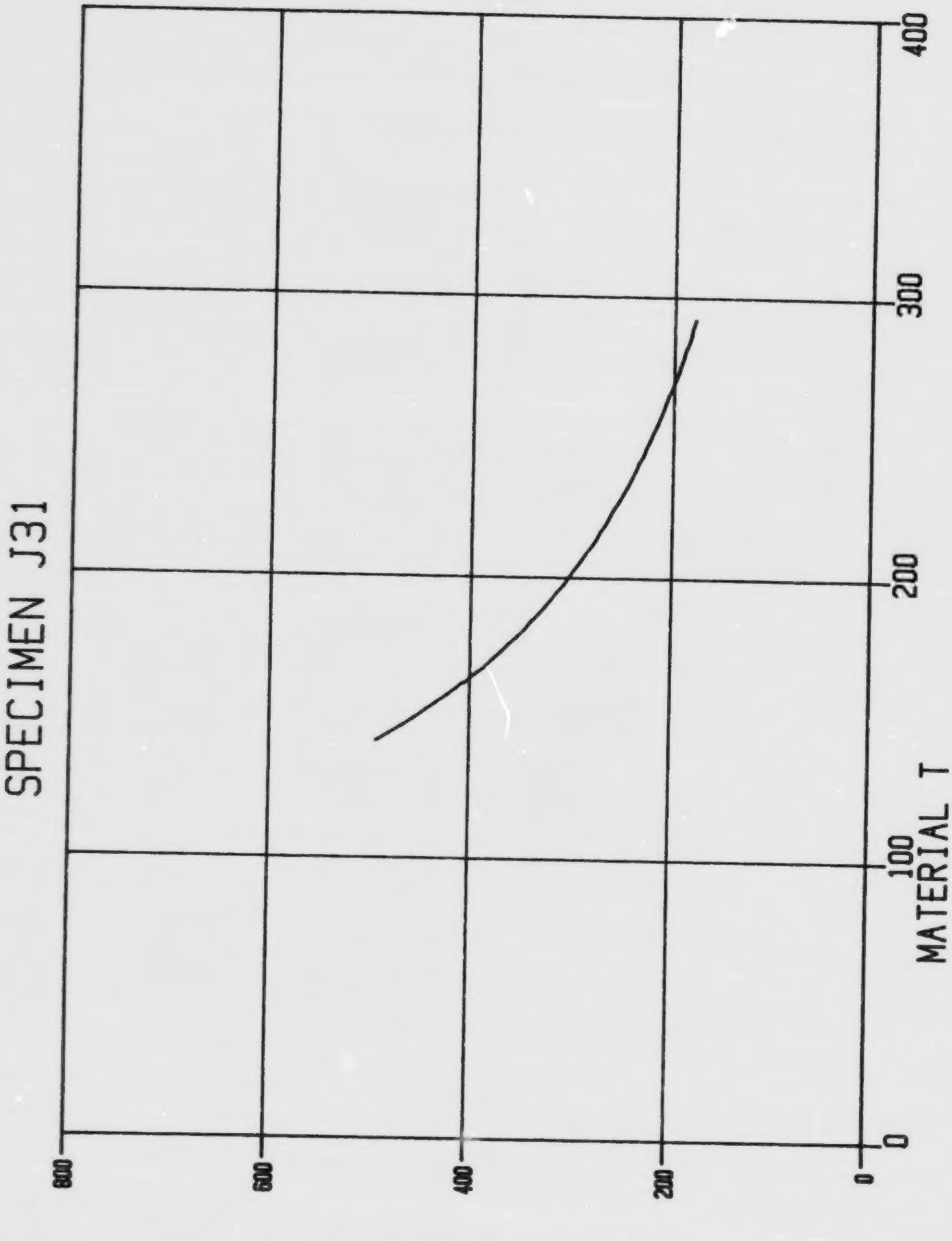
	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J30
1	6.287	0	
2	8.728	.034	
3	11.902	.077	
4	15.076	.123	
5	18.372	.176	
6	21.606	.233	
7	24.597	.298	
8	27.222	.375	
9	29.358	.469	
10	30.762	.587	
11	31.372	.726	
12	31.677	.878	
13	31.982	1.028	
14	32.166	1.183	
15	32.288	1.34	
16	32.349	1.5	
17	32.349	1.661	
18	32.349	1.823	
19	32.349	1.986	
20	32.227	2.15	
21	32.104	2.314	
22	31.982	2.48	
23	31.738	2.648	
24	31.555	2.815	
25	31.311	2.982	
26	30.945	3.159	
27	11.292	3.945	
28	12.39	4.075	

	J(KN/M)	T	W	J30
1	182.09	994.87	112	
2	208.89	233.4	22.78	
3	234.94	144.76	12.45	
4	261.34	318.96	24.56	
5	288.84	392.79	27.27	
6	315.07	113.23	7.13	
7	340.84	224.94	13.01	
8	367.83	236.3	12.59	
9	394.8	218.29	10.77	
10	421.46	208.15	9.56	
11	446.74	123.56	5.3	
12	470.7	96.51	3.88	
13	398.7	-30.27	-1.01	
14	317.94	31.58	1.31	


SPECIMEN J31 (RT)
SLOPE 185
INTERCEPT 136
J1C 172
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000



LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J31 (ALL DATA)


SPECIMEN J31
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

SPECIMEN NUMBER                                     J31
MATERIAL TYPE                                       A106B
MATERIAL CONDITION                                  WELD(PN229)
TEST TEMPERATURE(DEG C)                             20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           367
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         516.1
CRACK PLANE ORIENTATION (PER ASTM E399)             L-C
SPECIMEN THICKNESS B(CM)                            2.54
PERCENT SIDE GROOVE                                 20.472
SPECIMEN WIDTH W(CM)                                5.091
YOUNGS MODULUS AT TEST TEMP(Pa)                     1.92346E+11
EFFECTIVE MODULUS(Pa)                               2.12692115E+11

                 FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN               10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            22.81
INITIAL CRACK LENGTH-COMPLIANCE(CM)                 3.021

                 CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                      3.1
INITIAL A/W                                         .593
AVERAGE CRACK EXTENSION 9PT(CM)                     .216
DELTA A(CM) COMPLIANCE                              .196
MAX DEVIATION OF SINGLE MEASUREMENT %               2

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                    15
LAST POINT                     25
JIC(KN/M)                      172
CORRELATION COEFF              .99
SLOPE M(MPa)                   185
INTERCEPT B (KN/M)             136

                 VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD       YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD          YES

                 QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                            YES
CRACK SIZE DA<0.15*DELTA A                          YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     445.97
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   413.79
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.07
25*JQ/EF.Y.(CM)                                     .974

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED      15
LAST DATA POINT USED     25
CONSTANT(C1)             328.23
EXPONENT(C2)             .583
```

J31(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
23.68	2.65	.07	2.72	2.72	2.89	3.021	1
32.48	4.99	.18	5.17	5.17	5.49	3.017	2
41.67	8.22	.16	8.38	8.38	8.88	3.032	3
50.43	12.03	1.32	13.35	13.35	14.11	3.022	4
59.5	16.75	2.75	19.5	19.5	20.54	3.029	5
67.49	21.55	6.5	28.05	28.05	29.4	3.026	6
73.75	25.73	14.17	39.91	39.87	41.54	3.018	7
79.99	30.27	24.08	54.35	54.44	56.21	3.032	8
82.64	32.31	42.47	74.78	74.85	76.78	3.031	9
84.32	33.64	64.91	98.55	98.66	100.63	3.032	10
85.78	34.81	88.68	123.49	124.01	125.57	3.042	11
86.11	35.08	115.75	150.83	151.09	152.97	3.038	12
88.25	36.85	138.48	175.33	177.4	177.41	3.062	13
87.86	36.52	167.4	203.92	205.49	206.03	3.057	14
89.27	37.71	192.15	229.86	233.12	231.92	3.072	15
90.02	38.34	218.11	256.45	261.32	258.45	3.085	16
91.03	39.21	243.26	282.47	289.69	284.4	3.102	17
91.81	39.88	269.42	309.3	318.58	311.18	3.115	18
92.16	40.18	295.51	335.7	347.48	337.49	3.129	19
92.35	40.35	323.45	363.8	377.45	365.52	3.139	20
93.14	41.05	348.33	389.38	406.79	391.03	3.156	21
93.85	41.67	372.08	413.75	436.53	415.27	3.179	22
93.41	41.28	403.17	444.45	467.54	445.93	3.181	23
94.12	41.91	427.31	469.22	497.35	470.62	3.199	24
94.39	42.15	452.08	494.24	527.41	495.51	3.217	25

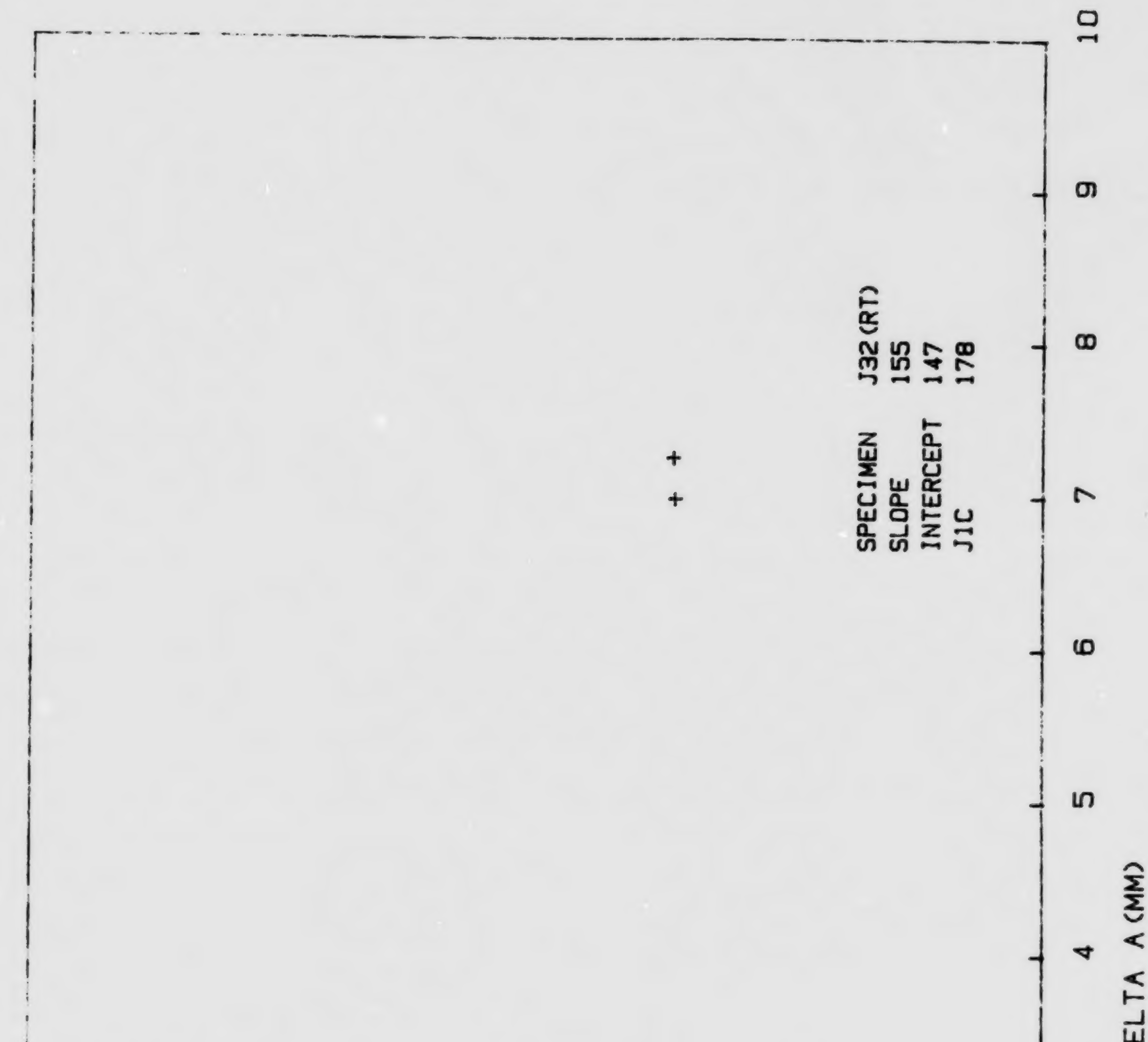
H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

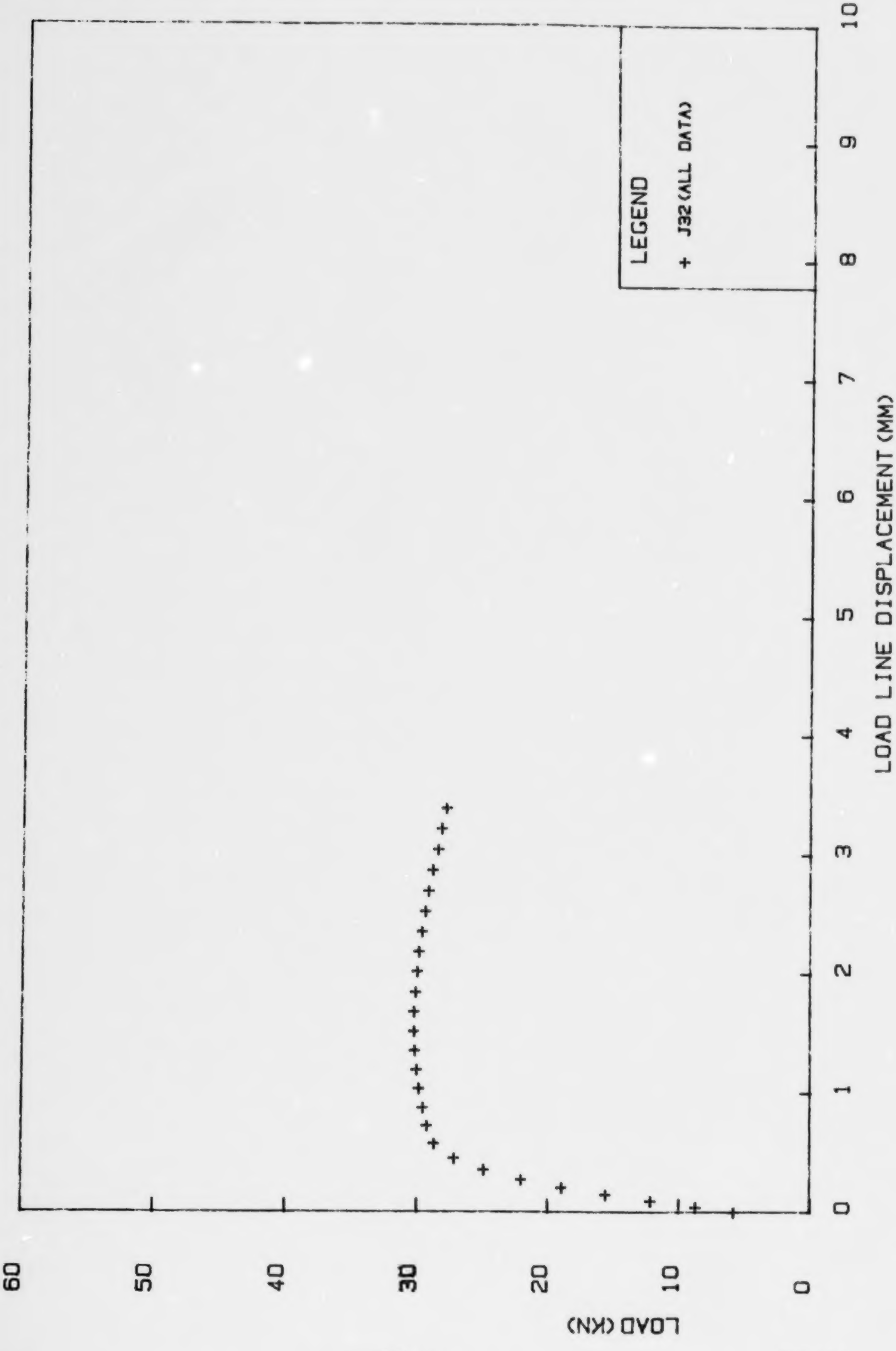
J31

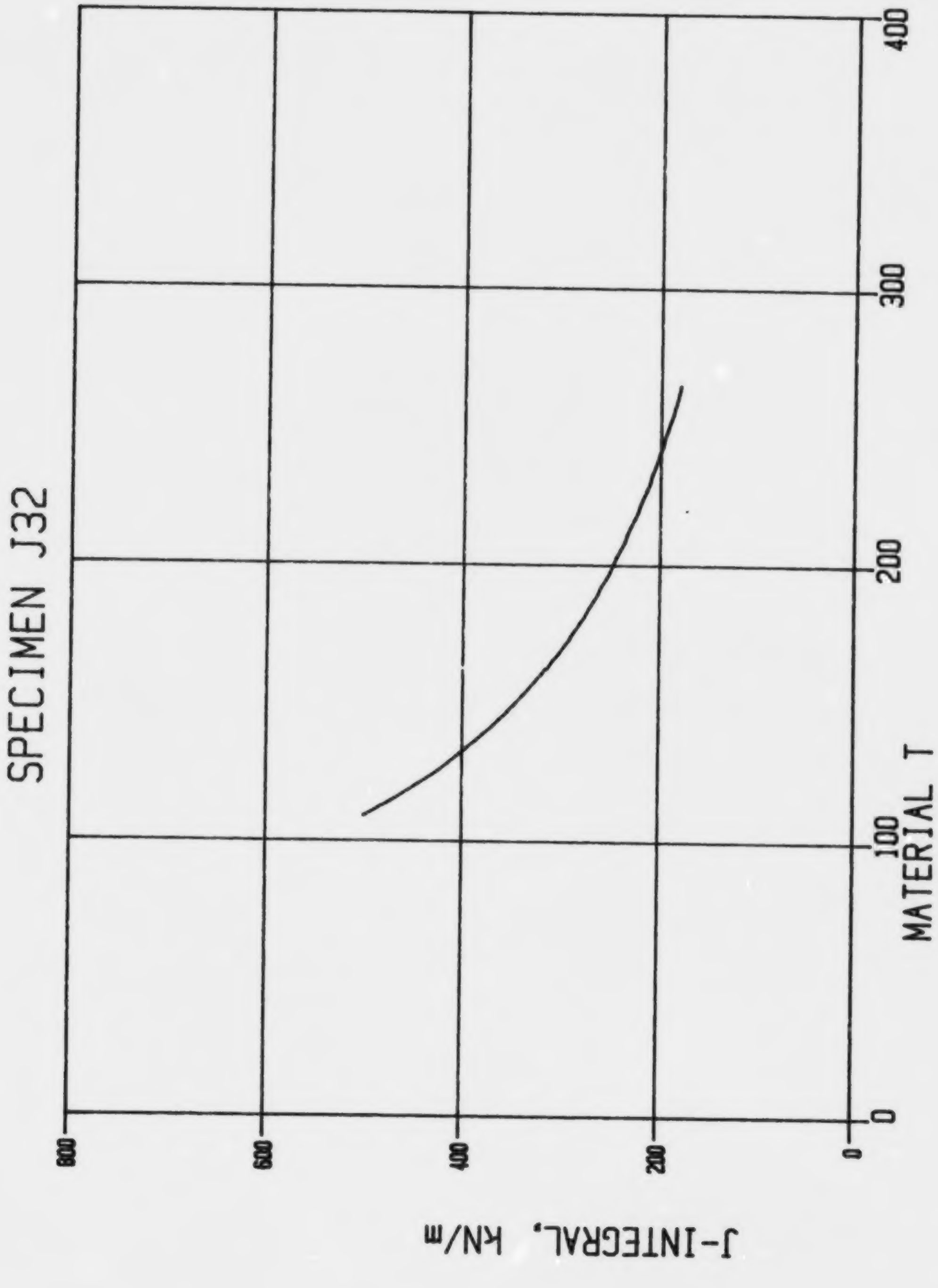
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.72	3.021	3.021	2E-03	.9992	1
5.17	3.016	3.017	-.041	.9996	2
8.38	3.031	3.032	.112	.9994	3
13.35	3.021	3.022	.012	.9994	4
19.5	3.028	3.029	.083	.9998	5
28.05	3.024	3.026	.052	.9995	6
39.91	3.016	3.018	-.028	.9998	7
54.35	3.029	3.032	.113	.9999	8
74.78	3.027	3.031	.101	.9999	9
98.55	3.028	3.032	.113	.9997	10
123.49	3.037	3.042	.214	.9998	11
150.83	3.031	3.038	.166	.9995	12
175.33	3.055	3.062	.413	.9997	13
203.92	3.048	3.057	.356	.9997	14
229.86	3.063	3.072	.514	.9998	15
256.45	3.075	3.085	.644	.9997	16
282.47	3.091	3.102	.81	.9998	17
309.3	3.103	3.115	.94	.9996	18
335.7	3.117	3.129	1.082	.9998	19
363.8	3.125	3.139	1.178	1	20
389.38	3.142	3.156	1.354	.9999	21
413.75	3.164	3.179	1.585	.9998	22
444.45	3.165	3.181	1.598	.9995	23
469.22	3.182	3.199	1.783	.9997	24
494.24	3.199	3.217	1.957	.9994	25

```
             LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J31
     1        6.287         0
     2        9.094          .039
     3       12.512          .084
     4       15.869          .131
     5       19.348          .186
     6       22.705          .244
     7       25.818          .313
     8       28.381          .396
     9       30.457          .493
    10       31.494          .618
    11       32.104          .759
    12       32.41           .909
    13       32.654         1.064
    14       32.837         1.221
    15       32.837         1.378
    16       32.959         1.538
    17       32.898         1.699
    18       32.837         1.862
    19       32.776         2.025
    20       32.532         2.189
    21       32.349         2.357
    22       32.166         2.524
    23       31.799         2.695
    24       31.616         2.867
    25       31.372         3.038
    26       31.006         3.21
```

	J(KN/M)	T	W	J31
1	163.08	97.91	12.35	
2	189.63	-489.94	-53.28	
3	216.89	161.56	15.24	
4	243.15	201.82	16.87	
5	269.46	154.11	11.53	
6	295.88	203.76	13.79	
7	322.5	183.78	11.33	
8	349.75	289.34	16.37	
9	376.59	143.69	7.48	
10	401.56	103.93	5.01	
11	429.1	2379.78	107.39	
12	456.84	131.9	5.54	
13	481.73	141.59	5.58	


SPECIMEN J32(RT)
SLOPE 155
INTERCEPT 147
J1C 178
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J32 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10



SPECIMEN J32
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J32
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN107)
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	367
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	516.1
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	20.787
SPECIMEN WIDTH W(CM)	5.09500001
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.15476637E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.31
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.107

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.191
INITIAL A/W	.61
AVERAGE CRACK EXTENSION 9PT(CM)	.26
DELTA A(CM) COMPLIANCE	.726
MAX DEVIATION OF SINGLE MEASUREMENT %	4.2

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	14
LAST POINT	23
JIC(KN/M)	178
CORRELATION COEFF	.99
SLOPE M(MPa)	155
INTERCEPT B (KN/M)	147

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	NO
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	444.2
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	278.68
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.988
25*JQ/EF.Y.(CM)	1.008

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	14
LAST DATA POINT USED	26
CONSTANT(C1)	310.8
EXPONENT(C2)	.5352

```
              J32(RT)

 K          J-ELASTIC       J-PLASTIC     JEL+JPL       J(M)          J(TO.AREA)  CR. LN
 (MPaRTM)    (KN/M)          (KN/M)        (KN/M)      (KN/M)           (KN/M)          (CM)

 24.23       2.78            0              2.78        2.78           2.98      3.104  1
 33.94       5.45            .14            5.59        5.59           5.96      3.112  2
 43.46       8.94            .43            9.37        9.37           9.98      3.112  3
 53.08       13.33           1.27           14.6        14.6           15.5      3.117  4
 61.59       17.95           4.14           22.09       22.08          23.32     3.113  5
 69.66       22.96           9.37           32.33       32.33          33.9      3.114  6
 75.81       27.19           18.62          45.81       45.79          47.68     3.111  7
 80.2        30.43           34.08          64.51       64.52          66.6      3.113  8
 81.58       31.49           56.71          88.19       88.15          90.37     3.111  9
 83.24       32.78           79.04          111.82      112.23         114       3.123  10
 84.1        33.46           104.67         138.13      138.54         140.36    3.123  11
 85.79       34.82           127.64         162.46      164.05         164.64    3.14   12
 87.92       36.57           150.09         186.66      190.38         188.76    3.165  13
 87.33       36.08           179.6          215.68      218.32         217.85    3.155  14
 88.2        36.8            204.99         241.8       245.88         243.91    3.167  15
 89.44       37.85           228.21         266.05      273.15         268.07    3.189  16
 89.94       38.27           254.9          293.17      302.05         295.12    3.2    17
 90.69       38.91           279.88         318.79      330.23         320.66    3.215  18
 90.89       39.08           305.9          344.98      358.76         346.75    3.227  19
 91.64       39.73           329.97         369.7       387.53         371.36    3.247  20
 92.05       40.09           354.8          394.89      416.11         396.45    3.262  21
 93.25       41.14           376.06         417.2       445.08         418.64    3.289  22
 92.69       40.65           403.28         443.93      474.5          445.23    3.299  23
 93.19       41.09           427.45         468.54      503.61         469.75    3.315  24
 93.88       41.7            447.97         489.68      531.67         490.76    3.337  25
 93.94       41.75           471.53         513.27      560.96         514.22    3.355  26
 58.92       16.42           346.83         363.25      564.8          399.37    3.806  27
 66.53       20.94           344.65         365.59      575.74         401.1     3.833  28

 H(M)             D(M)             POISSON'S RATIO
 .01905           2.54E-03         .3
```

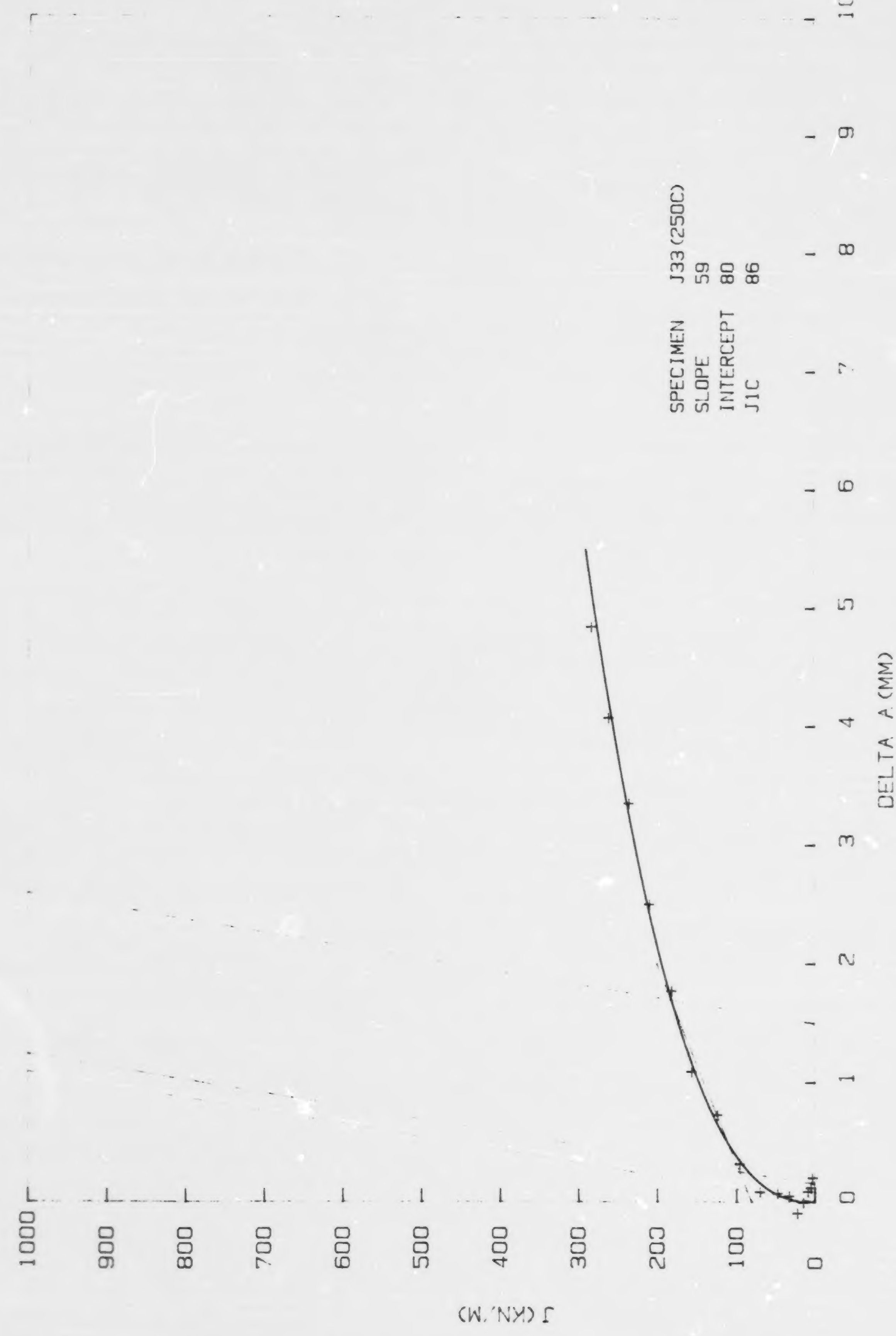
J32

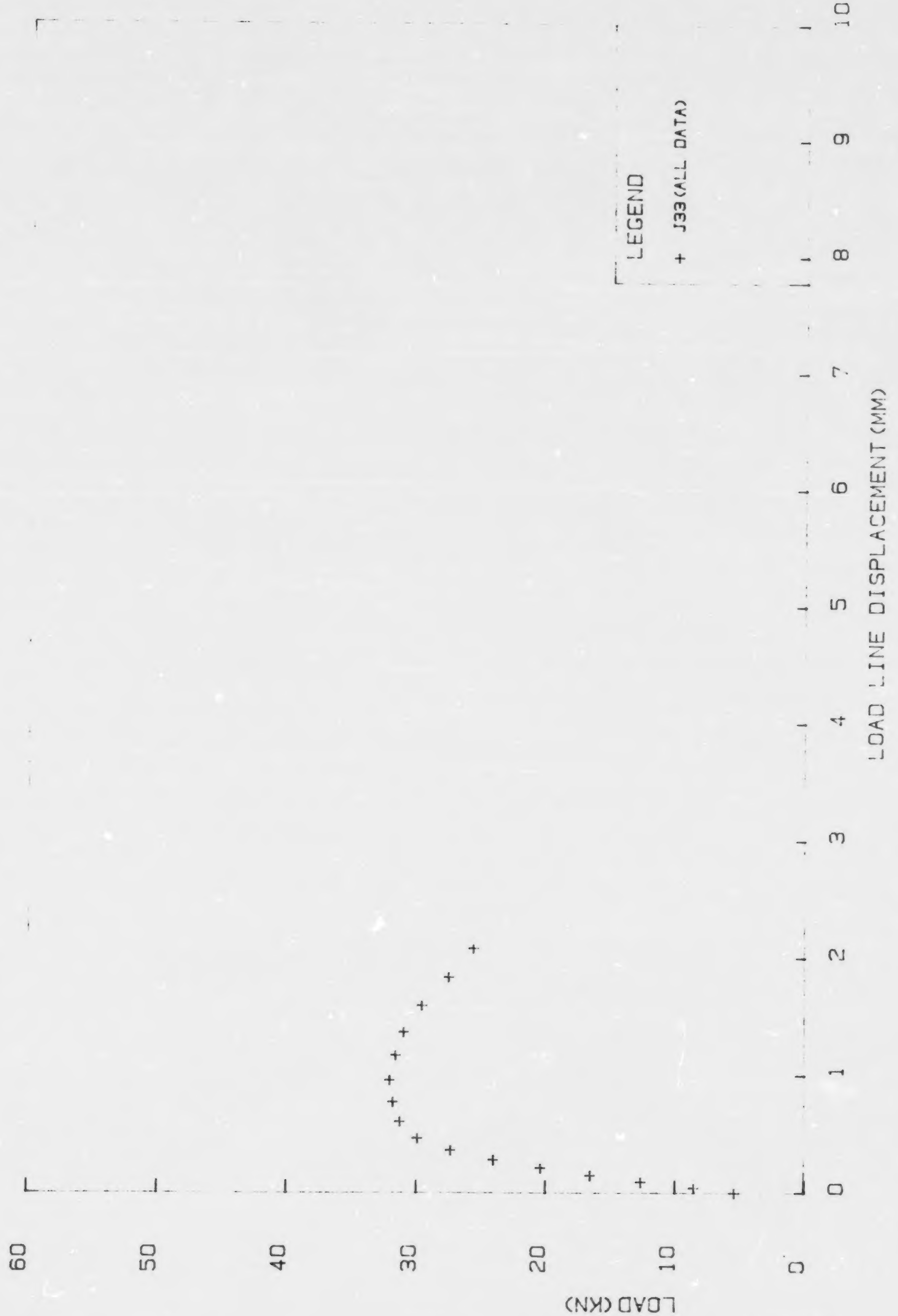
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.78	3.104	3.104	-.028	.9999	1
5.59	3.112	3.112	.055	.9998	2
9.37	3.111	3.112	.047	.9997	3
14.6	3.116	3.117	.103	.9998	4
22.09	3.111	3.113	.059	.9997	5
32.33	3.112	3.114	.068	.9999	6
45.81	3.109	3.111	.041	.9999	7
64.51	3.11	3.113	.061	.9998	8
88.19	3.107	3.111	.037	.9997	9
111.82	3.118	3.123	.16	.9999	10
138.13	3.117	3.123	.16	.9999	11
162.46	3.134	3.14	.331	.9998	12
186.66	3.158	3.165	.584	.9999	13
215.68	3.146	3.155	.477	.9999	14
241.8	3.158	3.167	.598	.9998	15
266.05	3.179	3.189	.817	.9999	16
293.17	3.189	3.2	.933	.9999	17
318.79	3.203	3.215	1.081	.9998	18
344.98	3.215	3.227	1.204	.9999	19
369.7	3.233	3.247	1.398	.9999	20
394.89	3.247	3.262	1.547	.9999	21
417.2	3.274	3.289	1.817	.9999	22
443.93	3.283	3.299	1.919	.9997	23
468.54	3.298	3.315	2.077	.9997	24
489.68	3.32	3.337	2.305	.9998	25
513.27	3.337	3.355	2.482	.9997	26
363.25	3.791	3.806	6.989	.9987	27
365.59	3.818	3.833	7.257	.9991	28

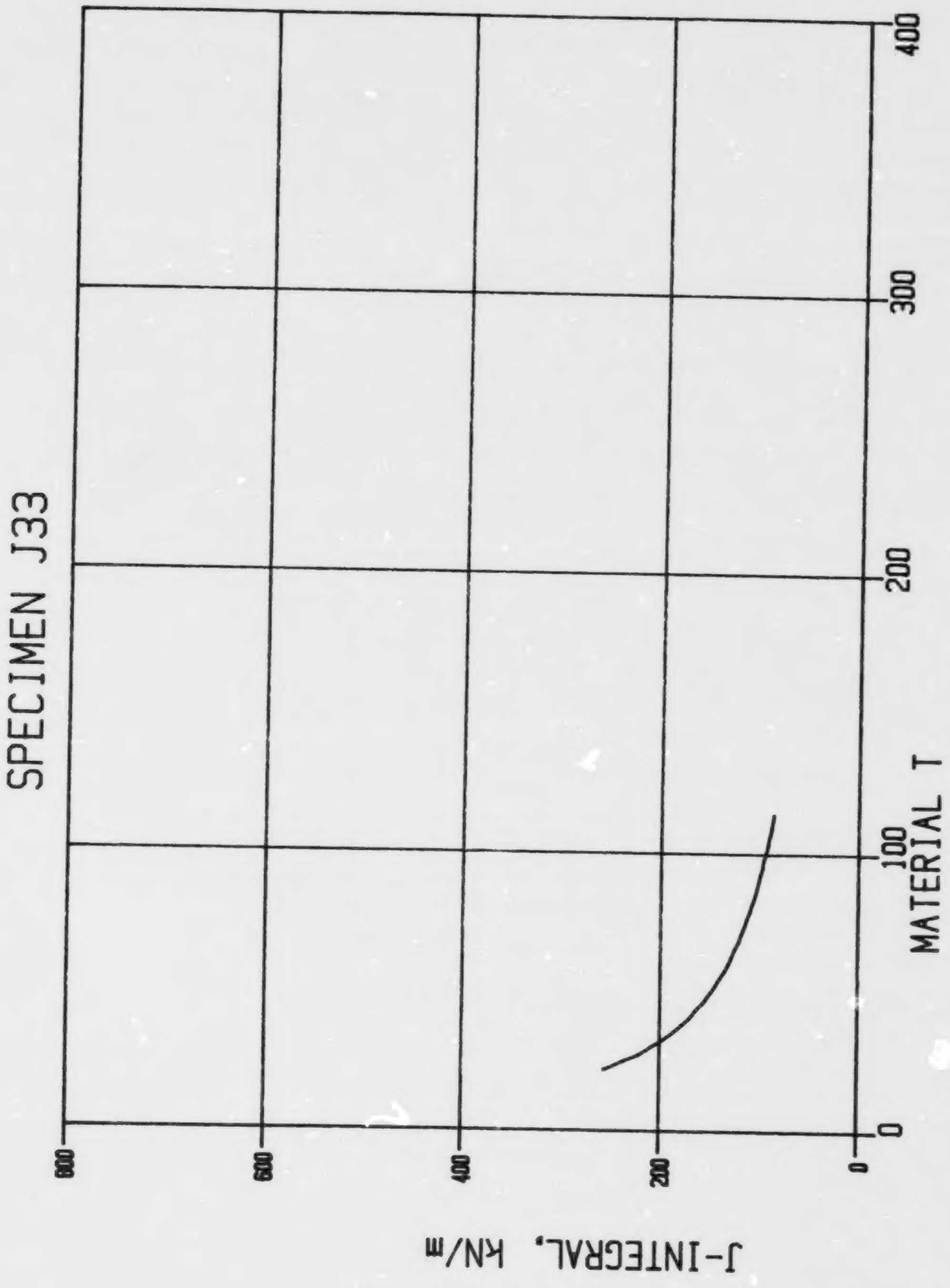
```
        J(KN/M)              T            W      J32

 1        174.56      94.37            10.57
 2        201.17      -265.65          -25.97
 3        228.74      212.73           18.18
 4        253.92      109.05           8.3
 5        279.61      230.4            15.82
 6        305.98      170.67           10.63
 7        331.89      209.96           11.98
 8        357.34      125.92           6.6
 9        382.29      166.87           8.11
 10       406.04      81.52            3.68
 11       430.56      259.05           10.95
 12       456.23      153.75           6.08
 13       479.11      91.41            3.4
 14       501.47      131.65           4.63
 15       438.26      -32.84           -.98
 16       364.42      8.62             .3
```

```
            LOAD(KN)       LOAD LINE DISPLACEMENT(MM)       J32
 1           5.798          0
 2           8.728          .042
 3          12.146          .094
 4          15.564          .146
 5          18.921          .205
 6          22.034          .273
 7          24.902          .355
 8          27.161          .45
 9          28.687          .574
 10         29.236          .721
 11         29.541          .873
 12         29.846          1.033
 13         30.029          1.19
 14         30.151          1.353
 15         30.212          1.514
 16         30.212          1.678
 17         30.09           1.843
 18         29.968          2.014
 19         29.846          2.181
 20         29.602          2.35
 21         29.358          2.522
 22         29.114          2.692
 23         28.809          2.867
 24         28.381          3.041
 25         28.137          3.215
 26         27.771          3.386
 27         27.344          3.563
 28         10.62           4.229
 29         11.597          4.359
```


J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
SPECIMEN J33(250C)
SLOPE 59
INTERCEPT 80
J1C 86


LEGEND
+ J33 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J33
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                    J33
 MATERIAL TYPE                                      A106B
 MATERIAL CONDITION                                 WELD(PN229)
 TEST TEMPERATURE(DEG C)                            250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          364
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        553.1
 CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
 SPECIMEN THICKNESS B(CM)                           2.54
 PERCENT SIDE GROOVE                                20.708
 SPECIMEN WIDTH W(CM)                               5.093
 YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
 EFFECTIVE MODULUS(Pa)                              1.96475243E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN              10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           21.83
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                2.963

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                     3.039
 INITIAL A/W                                        .582
 AVERAGE CRACK EXTENSION 9PT(CM)                    .476
 DELTA A(CM) COMPLIANCE                             .484
 MAX DEVIATION OF SINGLE MEASUREMENT %              4.3

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                      9
 LAST POINT                       12
 JIC(KN/M)                        86
 CORRELATION COEFF                .97
 SLOPE M(MPa)                     59
 INTERCEPT B (KN/M)               80

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD         YES
 LIGAMENT>25JIC/EFFECTIVE YIELD   YES
 DJ/DA<EFFECTIVE YIELD            YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                           NO
 CRACK SIZE DA<0.15*DELTA A                         YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    461.76
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  377.31
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.13
 25*JQ/EF.Y.(CM)                                    .469

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        9
 LAST DATA POINT USED       16
 CONSTANT(C1)               147
 EXPONENT(C2)               .4018
```

J33(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
21.64	2.33	.06	2.39	2.39	2.48	2.983	1
31.8	5.04	.04	5.08	5.08	5.34	2.975	2
41.54	8.59	.36	8.95	8.95	9.43	2.972	3
1.85	12.88	1.97	14.84	14.84	15.6	2.963	4
9.59	17.68	4.85	22.53	22.51	23.59	2.954	5
68.48	23.35	9.56	32.9	32.93	34.27	2.968	6
75.02	28.02	19.76	47.77	47.82	49.41	2.97	7
78.47	30.65	39.37	70.02	70.08	71.81	2.972	8
81.23	32.86	62.93	95.79	96.42	97.54	2.995	9
34.43	35.49	88.22	123.71	125.96	125.29	3.036	10
35.48	36.38	119.56	155.95	160.22	157.22	3.072	11
88.47	38.97	142.51	181.47	190.98	182.38	3.14	12
89.71	40.07	169.72	209.79	226.22	210.07	3.214	13
89.74	40.09	195.93	236.03	262.25	235.54	3.298	14
89.17	39.59	222.28	261.86	298.06	260.69	3.37	15
88.35	38.86	244.86	283.73	332.41	281.92	3.447	16

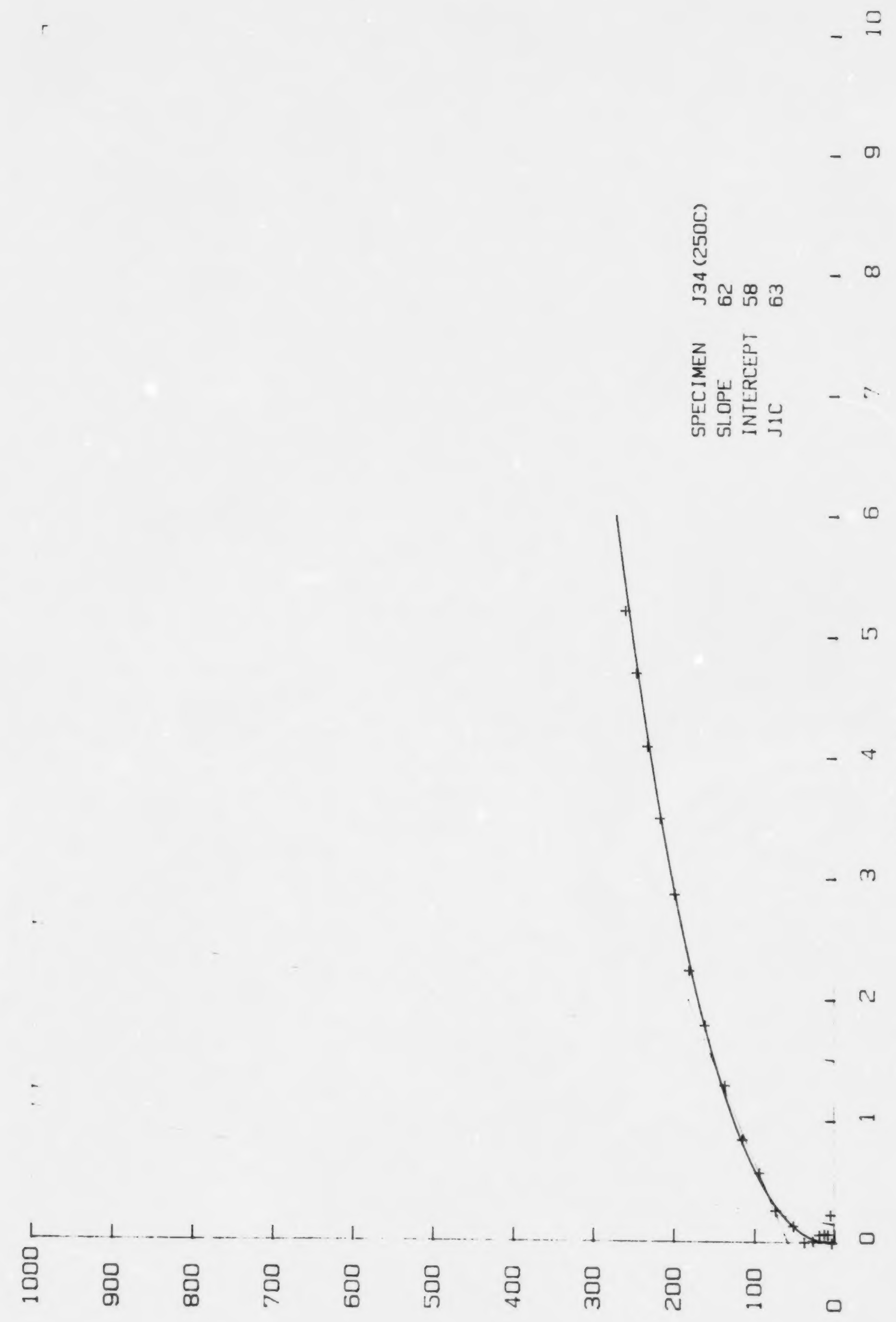
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

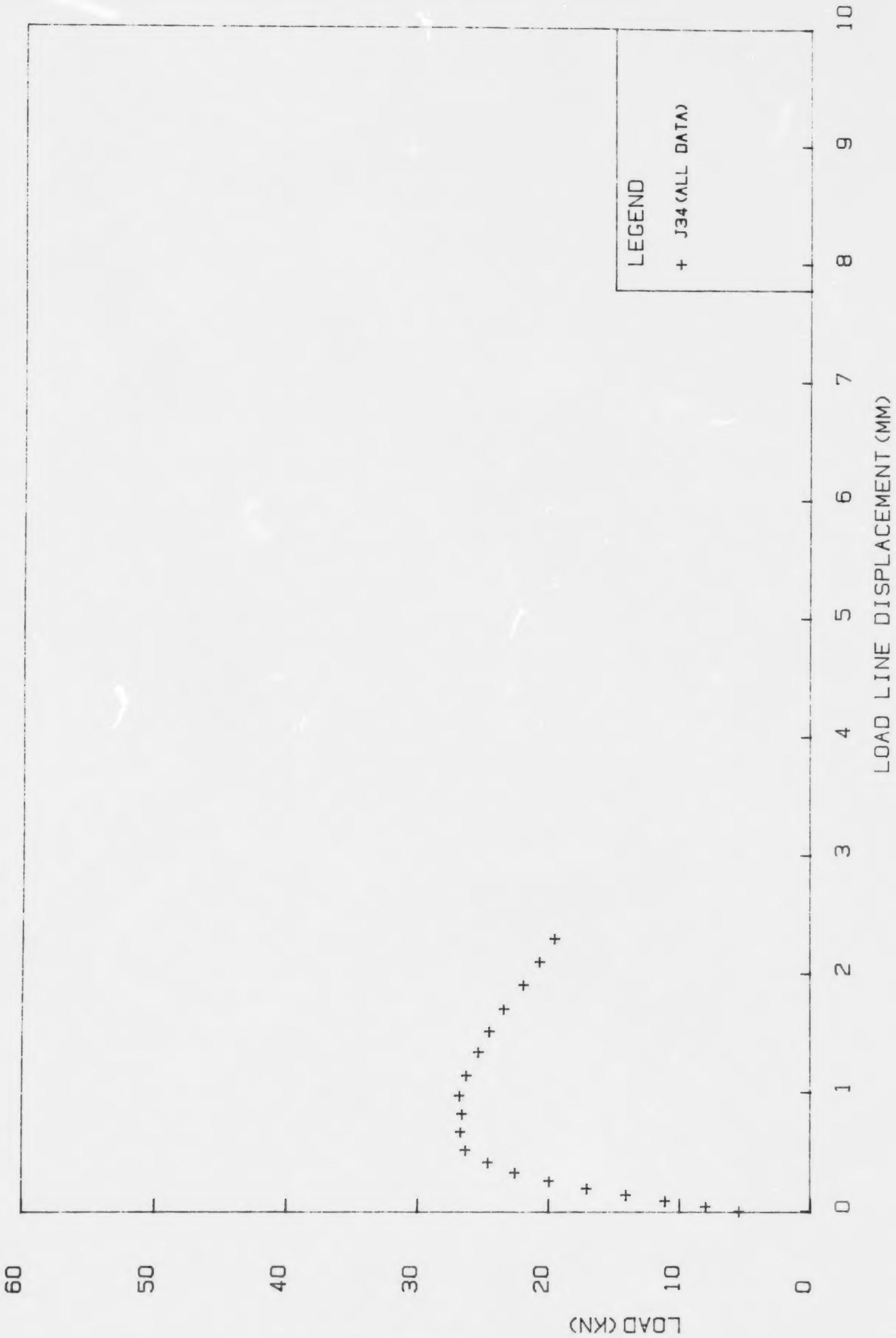
J33

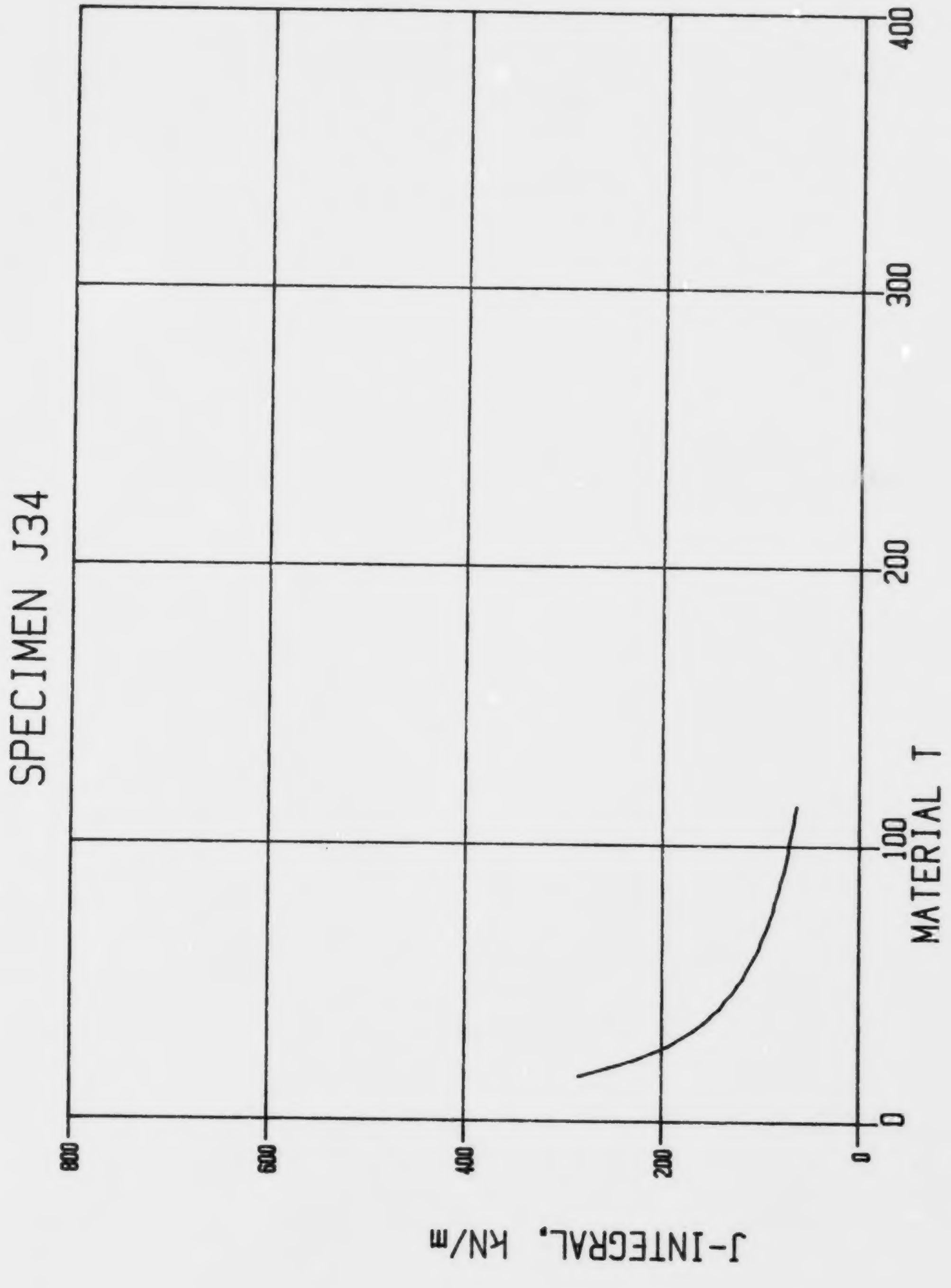
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.39	2.983	2.983	.205	.9993	1
5.08	2.975	2.975	.121	.9996	2
8.95	2.971	2.972	.088	.9995	3
14.84	2.961	2.963	-2E-03	.9998	4
22.53	2.952	2.954	-.094	.9999	5
32.9	2.966	2.968	.051	.9998	6
47.77	2.967	2.97	.073	.9997	7
70.02	2.968	2.972	.087	.9998	8
95.79	2.99	2.995	.32	.9999	9
123.71	3.03	3.036	.73	.9999	10
155.95	3.065	3.072	1.091	.9997	11
181.47	3.133	3.14	1.772	.9998	12
209.79	3.205	3.214	2.506	.9998	13
236.03	3.289	3.298	3.353	.9998	14
261.86	3.36	3.37	4.073	.9999	15
283.73	3.437	3.447	4.843	.9994	16

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J33
1	5.371	0	
	8.545	.044	
	12.634	.095	
4	16.541	.149	
5	20.386	.212	
6	24.048	.281	
7	27.344	.364	
8	29.907	.466	
9	31.25	.608	
10	31.799	.774	
11	32.043	.959	
12	31.555	1.169	
13	30.945	1.367	
14	29.541	1.594	
15	27.466	1.836	
16	25.574	2.08	
17	23.56	2.327	

	J(KN/M)	T	W	J33
1	82.9	96.12	27.98	
2	109.75	59.19	12.76	
3	139.83	77.49	12.88	
4	168.71	32.62	4.34	
5	195.63	33.54	3.71	
6	222.91	26.9	2.49	
7	248.95	31.19	2.48	
8	272.8	24.69	1.71	


SPECIMEN J34(250C)
SLOPE 62
INTERCEPT 58
J1C 63
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J34 (ALL DATA)


SPECIMEN J34
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J34
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN229)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	364
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	553.1
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	20.472
SPECIMEN WIDTH W(CM)	5.091
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.06930183E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.34
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.106

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.201
INITIAL A/W	.61
AVERAGE CRACK EXTENSION 9PT(CM)	.488
DELTA A(CM) COMPLIANCE	.521
MAX DEVIATION OF SINGLE MEASUREMENT %	4.2

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	9
LAST POINT	12
JIC(KN/M)	63
CORRELATION COEFF	.99
SLOPE M(MPa)	62
INTERCEPT B (KN/M)	58

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	463.14
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	335.72
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.985
25*JQ/EF.Y.(CM)	.343

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	9
LAST DATA POINT USED	19
CONSTANT(C1)	126.06
EXPONENT(C2)	.4397

J34(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.23	2.46	.04	2.5	2.5	2.67	3.106	1
1.46	4.93	-.2	4.72	4.72	5.03	3.129	2
9.42	7.74	.45	8.19	8.19	8.71	3.113	3
47.8	11.38	1.29	12.66	12.66	13.43	3.113	4
55.79	15.5	3.38	18.87	18.88	19.92	3.112	5
62.87	19.68	7.16	26.83	26.82	28.17	3.107	6
68.59	23.42	14.28	37.7	37.69	39.29	3.106	7
74.13	27.36	24.22	51.57	51.68	53.37	3.12	8
75.9	28.68	44.86	73.54	73.85	75.35	3.132	9
77.49	29.9	64.22	94.11	95.34	95.78	3.163	10
79.8	31.7	83.48	115.19	117.59	116.79	3.19	11
81.15	32.79	104.11	136.89	141.81	138.23	3.235	12
81.74	33.27	128.3	161.57	170.03	162.48	3.285	13
82.22	33.66	148.07	181.73	194.27	182.34	3.33	14
83.22	34.48	165.9	200.38	219.6	200.6	3.393	15
82.59	33.96	185.32	219.29	246.19	219.01	3.455	16
82.69	34.05	201.6	235.64	270.87	235	3.514	17
83.09	34.38	215.73	250.1	294.91	249.15	3.575	18
82.6	33.97	230.45	264.42	318.24	263.17	3.627	19

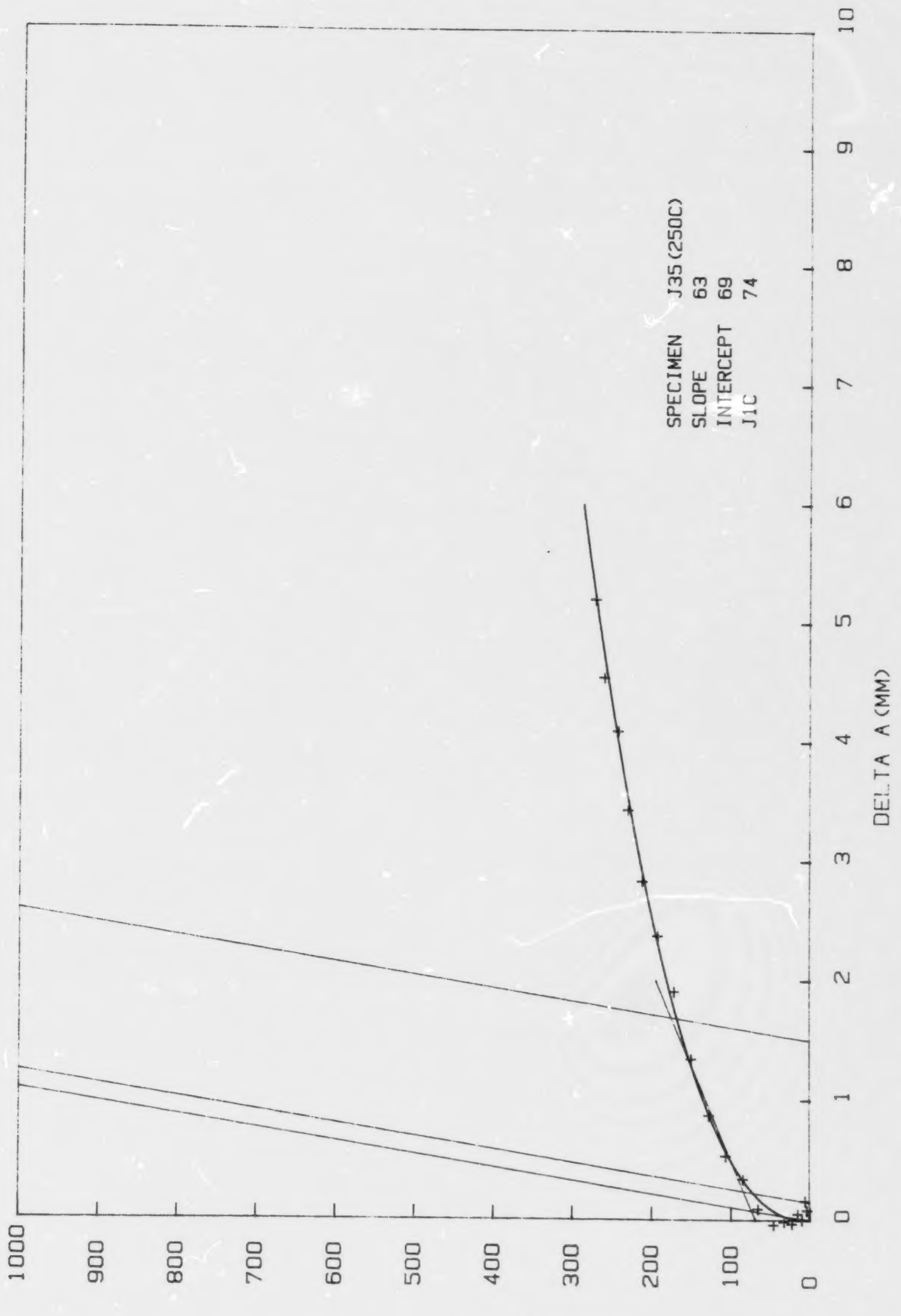
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

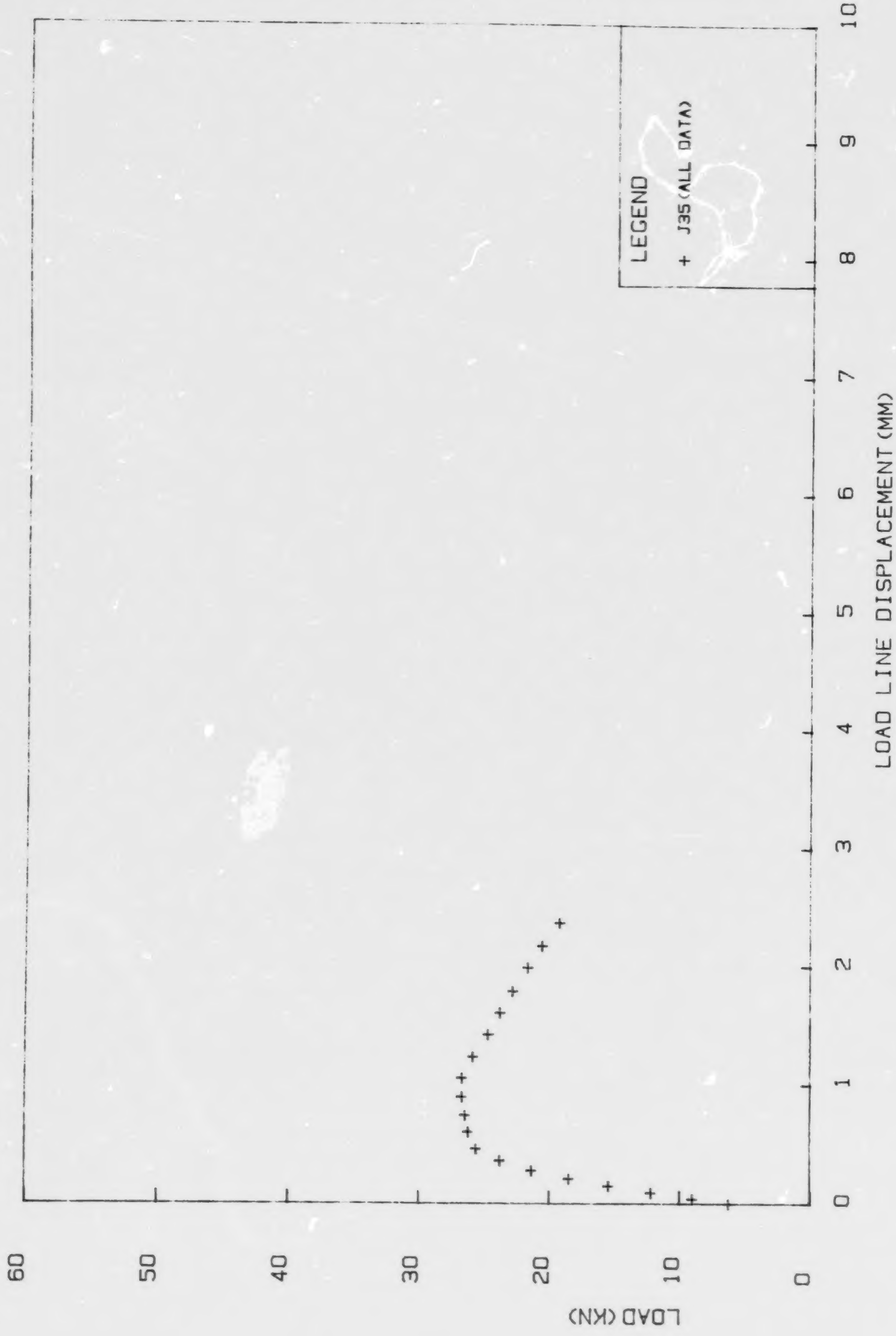
J34

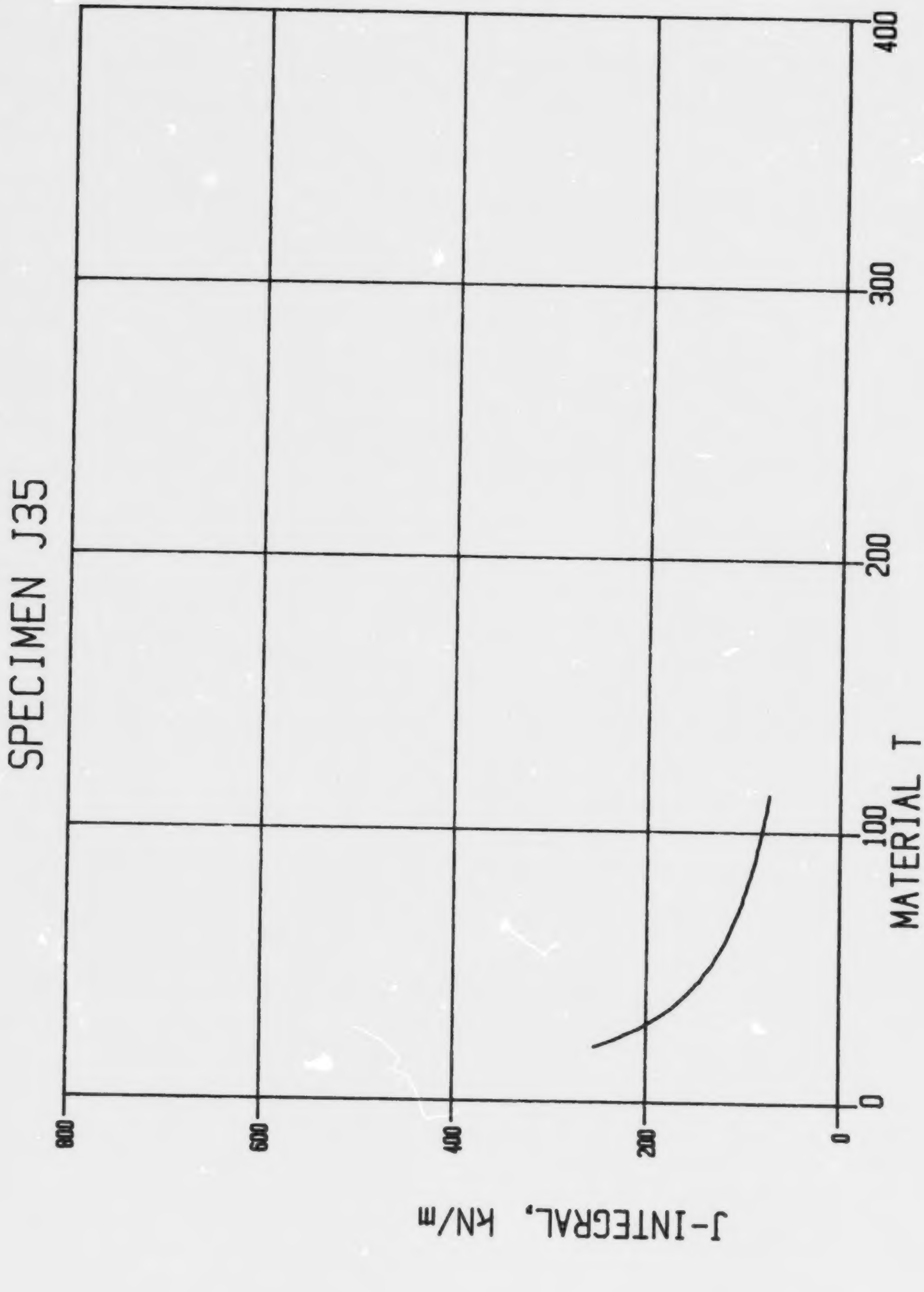
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.5	3.106	3.106	-2E-03	.9981	1
4.72	3.128	3.129	.227	.9997	2
8.19	3.112	3.113	.067	.9999	3
12.66	3.112	3.113	.072	.9995	4
18.87	3.111	3.112	.065	.9994	5
26.83	3.105	3.107	.013	.9997	6
37.7	3.104	3.106	3E-03	.9999	7
51.57	3.117	3.12	.136	.9998	8
73.54	3.128	3.132	.259	1	9
94.11	3.159	3.163	.571	.9998	10
115.19	3.185	3.19	.845	.9999	11
136.89	3.229	3.235	1.29	.9997	12
161.57	3.278	3.285	1.785	.9999	13
181.73	3.322	3.33	2.237	.9998	14
200.38	3.385	3.393	2.867	.9996	15
219.29	3.447	3.455	3.494	.9999	16
235.64	3.505	3.514	4.085	.9999	17
250.1	3.566	3.575	4.691	.9999	18
264.42	3.617	3.627	5.207	.9998	19

```
              LOAD(KN)       LOAD LINE DISPLACEMENT(MM)       J34
 1             5.432           0
               7.996           .04
              11.108           .087
 4            14.099           .138
 5            17.09            .193
 6            19.958           .256
 7            22.583           .326
 8            24.658           .411
 9            26.367           .515
 10           26.733           .669
 11           26.611           .82
 12           26.794           .974
 13           26.245          1.144
 14           25.33           1.343
 15           24.475          1.516
 16           23.376          1.705
 17           21.851          1.908
 18           20.63           2.102
 19           19.47           2.297
 20           18.311          2.489
```

	J(KN/M)	T	W	J34
1	62.56	155.79	56.12	
2	83.83	57.24	15.14	
3	104.65	67.01	14	
4	126.04	42.35	7.17	
5	149.23	43.34	6.04	
6	171.65	38.8	4.58	
7	191.06	25.74	2.63	
8	209.83	26.2	2.35	
9	227.47	24.07	1.92	
10	242.87	20.73	1.49	
11	257.26	24.1	1.58	


SPECIMEN J35(250C)
SLOPE 63
INTERCEPT 69
J1C 74
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J35 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J35
J-INTEGRAL, kN/m
MATERIAL T
0
200
400
600
800
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J35
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN229)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	364
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	553.1
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.541
PERCENT SIDE GROOVE	20.425
SPECIMEN WIDTH W(CM)	5.093
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.06505811E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.69
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.126

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.227
INITIAL A/W	.614
AVERAGE CRACK EXTENSION 9PT(CM)	.495
DELTA A(CM) COMPLIANCE	.52
MAX DEVIATION OF SINGLE MEASUREMENT %	5.2

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	9
LAST POINT	12
JIC(KN/M)	74
CORRELATION COEFF	.97
SLOPE M(MPa)	63
INTERCEPT B (KN/M)	69

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	463.59
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	331.81
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.967
25*JQ/EF.Y.(CM)	.403

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	9
LAST DATA POINT USED	19
CONSTANT(C1)	135.37
EXPONENT(C2)	.4226

J35(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
25.65	3.28	-.02	3.26	3.26	3.45	3.135	1
34.89	6.06	.01	6.07	6.07	6.44	3.143	2
43.56	9.45	.81	10.26	10.26	10.89	3.126	3
2.39	13.67	2	15.66	15.66	16.57	3.132	4
0.11	17.99	5.05	23.04	23.03	24.26	3.123	5
67.07	22.4	10.67	33.07	33.07	34.58	3.125	6
72.08	25.87	20.56	46.43	46.41	48.19	3.122	7
74.59	27.7	38.56	66.27	66.42	68.06	3.136	8
76.8	29.36	55.91	85.27	86.06	87.03	3.16	9
78.75	30.88	76.21	107.09	108.59	108.8	3.18	10
30.98	32.65	95.46	128.11	131.34	129.7	3.213	11
81.62	33.17	117.65	150.82	157.12	152.06	3.26	12
81.92	33.41	138.87	172.28	183.19	173.08	3.317	13
82.3	33.72	159.22	192.94	208.48	193.41	3.364	14
82.35	33.76	178.82	212.58	233.38	212.71	3.409	15
82.79	34.12	196.42	230.54	259.27	230.28	3.469	16
84	35.13	208.52	243.65	282.34	243.13	3.535	17
82.31	33.73	227.31	261.04	307.2	260.11	3.58	18
82.18	33.62	238.66	272.28	330.51	271.09	3.646	19

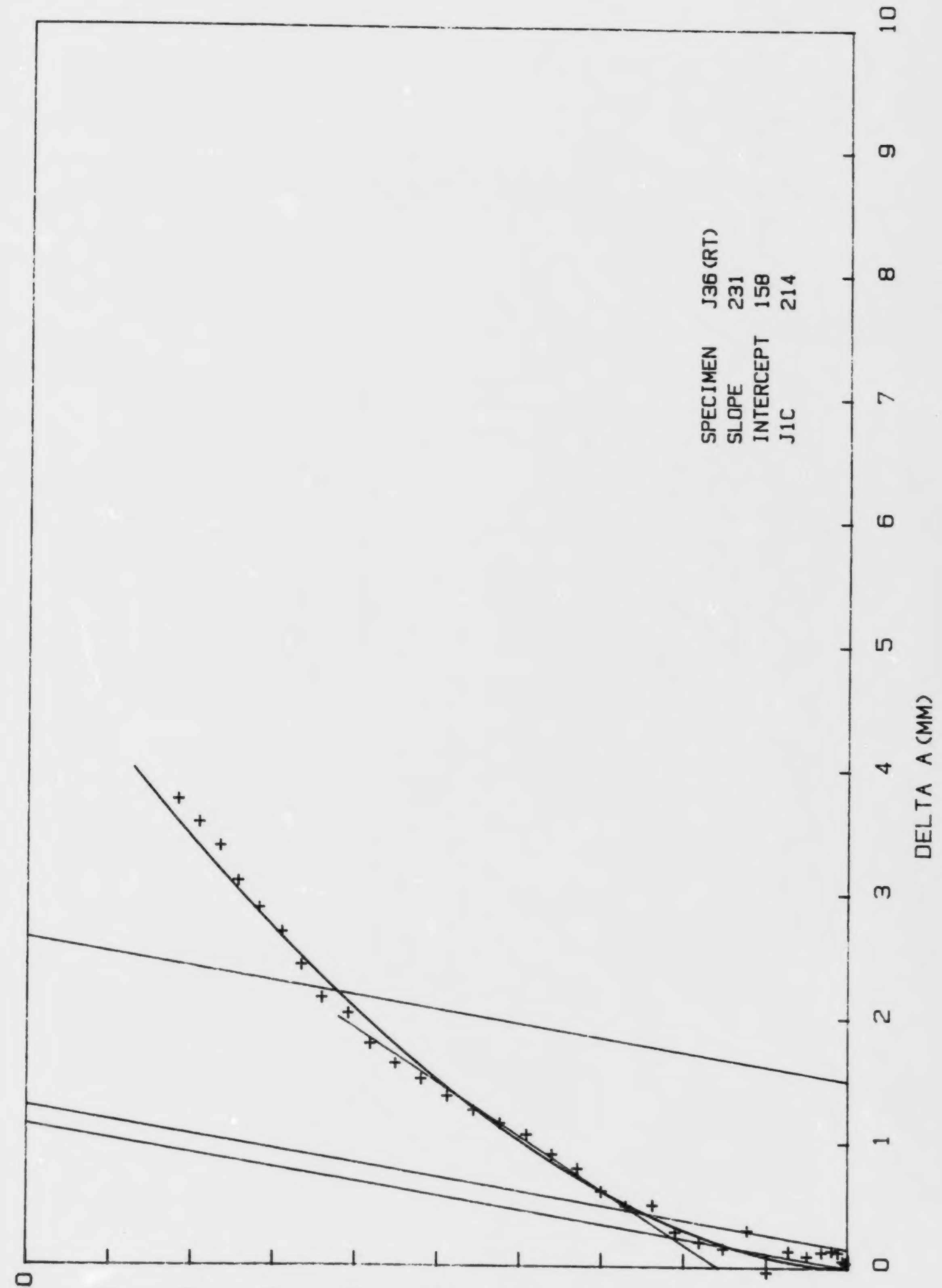
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

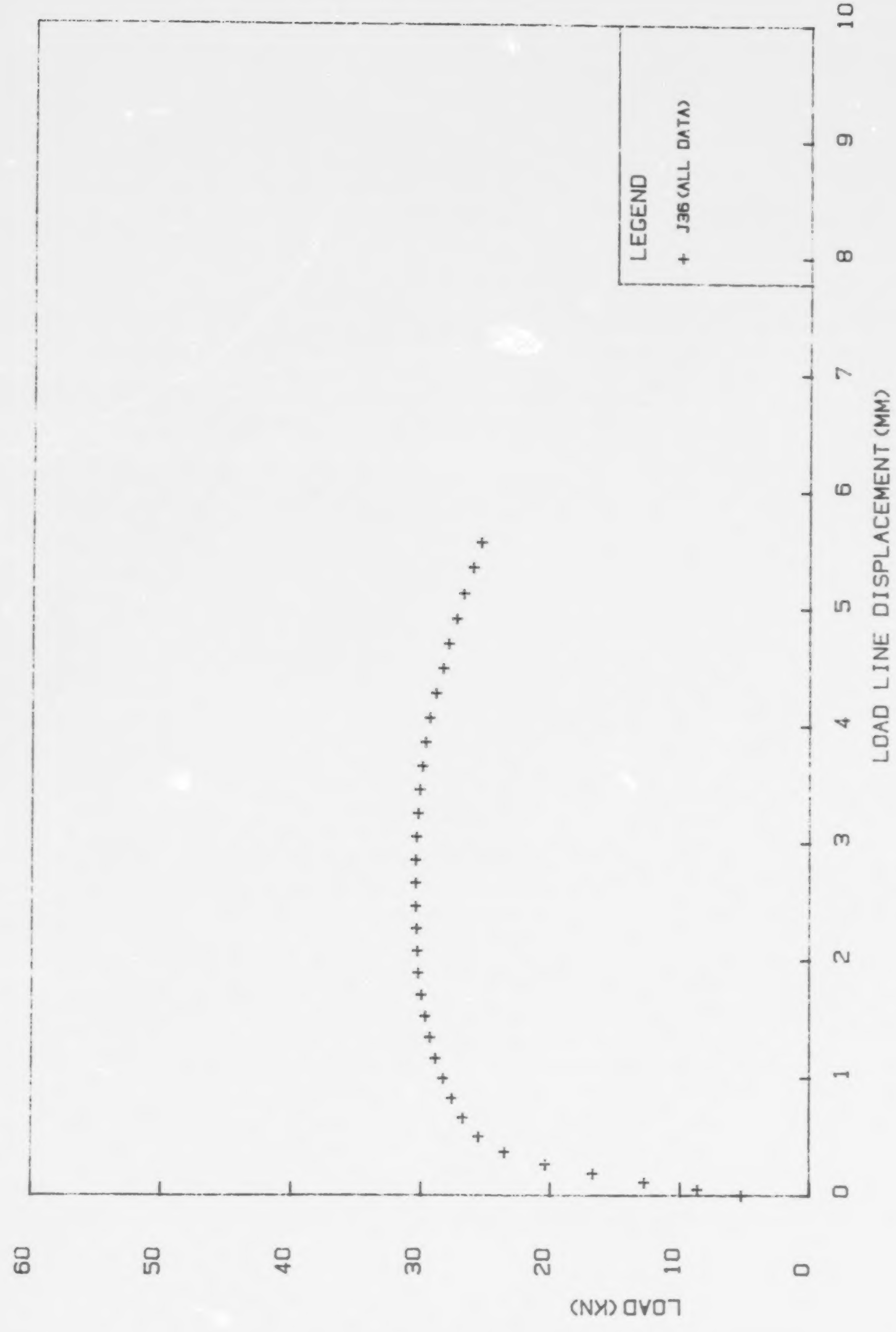
J35

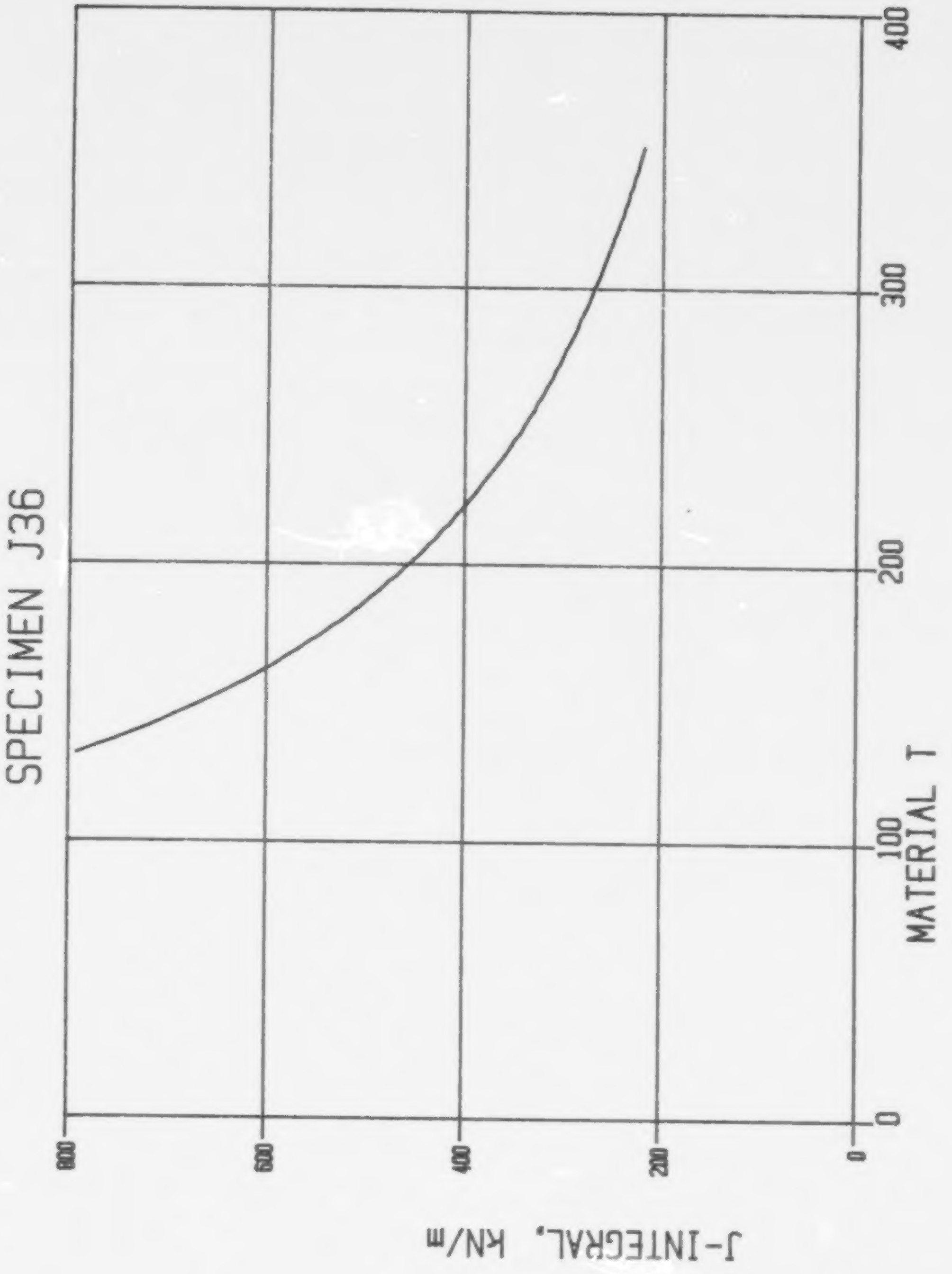
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
3.26	3.134	3.135	.086	.9996	1
6.07	3.142	3.143	.165	.9998	2
10.26	3.126	3.126	3E-03	.9999	3
15.66	3.13	3.132	.055	.9997	4
23.04	3.122	3.123	-.029	.9997	5
33.07	3.123	3.125	-.011	.9997	6
46.43	3.12	3.122	-.037	.9998	7
66.27	3.132	3.136	.096	.9999	8
85.27	3.156	3.16	.341	.9993	9
107.09	3.175	3.18	.536	.9997	10
128.11	3.208	3.213	.872	.9998	11
150.82	3.254	3.26	1.344	.9999	12
172.28	3.31	3.317	1.908	.9998	13
192.94	3.356	3.364	2.376	.9998	14
212.58	3.401	3.409	2.831	.9999	15
230.54	3.46	3.469	3.427	.9999	16
243.65	3.526	3.535	4.09	.9999	17
261.04	3.571	3.58	4.543	.9999	18
272.28	3.636	3.646	5.198	.9999	19

	J(KN/M)	T	W	J35
	75.77	67.37	19.77	
2	96.18	97.43	22.3	
3	117.6	54.42	10.01	
4	139.46	41.77	6.31	
5	161.55	33.08	4.18	
6	182.61	38.41	4.18	
7	202.76	37.52	3.59	
8	221.56	26.19	2.21	
9	237.1	17.17	1.3	
10	252.34	33.39	2.3	
11	266.66	14.92	.93	

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J35
1	6.226	0	
2	9.033	.043	
3	12.207	.094	
4	15.442	.15	
5	18.494	.211	
6	21.362	.28	
7	23.804	.363	
8	25.635	.461	
9	26.245	.604	
10	26.489	.743	
11	26.733	.898	
12	26.733	1.056	
13	25.879	1.237	
14	24.719	1.425	
15	23.804	1.608	
16	22.827	1.791	
17	21.667	1.99	
18	20.569	2.175	
19	19.226	2.371	
20	17.883	2.571	


SPECIMEN J36 (RT)
SLOPE 231
INTERCEPT 158
J1C 214
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J36 (ALL DATA)



SPECIMEN J36

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J36
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                HAZ(PN-229)
 TEST TEMPERATURE(DEG C)                           20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         367
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       516.1
 CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
 SPECIMEN THICKNESS B(CM)                          2.54
 PERCENT SIDE GROOVE                               21.141
 SPECIMEN WIDTH W(CM)                              5.084
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.92346E+11
 EFFECTIVE MODULUS(Pa)                             2.1601046E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          24.77
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.123

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.215
 INITIAL A/W                                       .614
 AVERAGE CRACK EXTENSION 9PT(CM)                   .385
 DELTA A(CM) COMPLIANCE                            .375
 MAX DEVIATION OF SINGLE MEASUREMENT %             4.6

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                  14
 LAST POINT                   26
 JIC(KN/M)                    214
 CORRELATION COEFF            .99
 SLOPE M(MPa)                 231
 INTERCEPT B (KN/M)           158

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          NO
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   442.21
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 350.23
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  1.961
 25*JQ/EF.Y.(CM)                                   1.212

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED     14
 LAST DATA POINT USED    33
 CONSTANT(C1)            397.58
 EXPONENT(C2)            .5665
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]CATALOG

DISK VOLUME 254


            J36(RT)

 K         J-ELASTIC      J-PLASTIC      JEL+JPL       J(M)        J(TO.AREA)   CR. LN
  PaRTM)   (KN/M)         (KN/M)         (KN/M)      (KN/M)          (KN/M)        (CM)

  4.73     2.89           .03            2.92          2.92         3.11      3.128  1
 36.43     6.28           .06            6.34          6.34         6.77      3.129  2
 48.03     10.92          1.33           12.24         12.24        12.98     3.136  3
 58.61     16.25          3.76           20.02         20.02        21.14     3.137  4
 67.67     21.67          10.69          32.36         32.36        33.88     3.136  5
 73.27     25.4           25.05          50.44         50.42        52.25     3.133  6
 77.02     28.06          45.05          73.11         73.16        75.08     3.137  7
 78.37     29.06          70.48          99.53         99.06        101.73    3.119  8
 82.49     32.19          90.95          123.14        124.22       125.27    3.153  9
 83.26     32.8           119.46         152.26        152.45       154.58    3.138  10
 84.84     34.05          146.88         180.93        181.51       183.28    3.143  11
 86.47     35.37          174.58         209.95        211.34       212.32    3.152  12
 88.89     37.39          200.24         237.63        241.49       239.94    3.173  13
 89.55     37.94          231.9          269.84        273.58       272.2     3.172  14
 90.61     38.85          261.29         300.14        305.73       302.44    3.184  15
 92.19     40.21          288.81         329.02        337.82       331.24    3.202  16
 93.26     41.15          319.25         360.4         371.43       362.56    3.213  17
 94.52     42.27          349.16         391.42        405.91       393.49    3.229  18
 95.25     42.92          380.98         423.9         440.54       425.91    3.238  19
 95.91     43.52          412.77         456.29        475.67       458.23    3.248  20
 96.47     44.03          444.16         488.19        510.83       490.04    3.26   21
 97.21     44.71          475.28         519.99        546.81       521.74    3.273  22
 97.7      45.16          506.27         551.43        582.45       553.07    3.286  23
 98.26     45.68          536.5          582.18        618.79       583.68    3.302  24
 99.41     46.75          562.29         609.04        655          610.39    3.326  25
 98.87     46.24          595.14         641.39        692.35       642.54    3.339  26
 99.36     46.71          619.86         666.57        728.87       667.52    3.365  27
 100.32    47.62          642.81         690.43        764.76       691.22    3.391  28
 99.93     47.24          671.14         718.38        801.85       718.95    3.411  29
 99.97     47.28          696.77         744.06        838.35       744.42    3.432  30
 99.95     47.26          718.87         766.13        875.25       766.26    3.46   31
   .46     46.8           744.71         791.51        911.11       791.42    3.479  32
    59     46.92          770.46         817.38        947.46       817.12    3.498  33

  (M)           D(M)          POISSON'S RATIO
 .01902         2.54E-03      .3
```

J36

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.92	3.127	3.128	.046	.9999	1
6.34	3.128	3.129	.06	.9999	2
12.24	3.135	3.136	.129	1	3
20.02	3.136	3.137	.141	.9999	4
32.36	3.134	3.136	.13	1	5
50.44	3.13	3.133	.097	1	6
73.11	3.133	3.137	.138	.9999	7
99.53	3.115	3.119	-.035	.9999	8
123.14	3.148	3.153	.301	.9999	9
152.26	3.132	3.138	.154	1	10
180.93	3.136	3.143	.204	1	11
209.95	3.143	3.152	.285	.9999	12
237.63	3.163	3.173	.498	1	13
269.84	3.161	3.172	.489	.9999	14
300.14	3.172	3.184	.608	.9999	15
329.02	3.19	3.202	.79	1	16
360.4	3.2	3.213	.903	.9998	17
391.42	3.215	3.229	1.061	.9998	18
423.9	3.223	3.238	1.151	.9999	19
456.29	3.232	3.248	1.255	.9999	20
488.19	3.242	3.26	1.369	.9999	21
519.99	3.255	3.273	1.503	.9998	22
551.43	3.266	3.286	1.63	.9999	23
582.18	3.281	3.302	1.786	.9999	24
609.04	3.305	3.326	2.031	.9997	25
641.39	3.316	3.339	2.155	.9999	26
666.57	3.342	3.365	2.419	.9999	27
690.43	3.368	3.391	2.684	.9999	28
718.38	3.386	3.411	2.876	.9998	29
744.06	3.407	3.432	3.092	.9999	30
766.13	3.434	3.46	3.374	.9998	31
791.51	3.453	3.479	3.565	.9997	32
817.38	3.47	3.498	3.747	.9998	33

	J(KN/M)	T	W	J36
	223.79	128.17	11.09	
	253.73	-3456.39	-264.01	
3	284.99	252.22	17.05	
4	314.58	156.45	9.49	
5	344.71	273.3	15.03	
6	375.91	193.51	9.68	
7	407.66	356.61	16.37	
8	440.09	307.88	13.02	
9	472.24	276.46	10.82	
10	504.09	232.95	8.48	
11	535.71	245.8	8.36	
12	566.8	193.87	6.18	
13	595.61	108.21	3.24	
14	625.22	257.17	7.28	
15	653.98	94.24	2.51	
16	678.5	88.63	2.24	
17	704.4	143.76	3.46	
18	731.22	117.2	2.68	
19	755.09	77.23	1.68	
20	778.82	131.58	2.75	
21	804.45	140.27	2.8	

```
             LOAD(KN)        LOAD LINE DISPLACEMENT(MM)       J36
 1            5.249           0
 2            8.667           .051
 3            12.756          .112
 4            16.724          .188
 5            20.386          .266
 6            23.56           .369
 7            25.574          .5
 8            26.794          .657
 9            27.649          .823
 10           28.32           .991
 11           28.931          1.162
 12           29.358          1.34
 13           29.724          1.521
 14           30.029          1.704
 15           30.273          1.89
 16           30.334          2.078
 17           30.396          2.266
 18           30.457          2.458
 19           30.457          2.656
 20           30.457          2.852
 21           30.396          3.049
 22           30.273          3.247
 23           30.151          3.45
 24           29.968          3.65
 25           29.724          3.855
 26           29.419          4.063
 27           28.931          4.272
 28           28.381          4.485
 29           27.954          4.695
 30           27.344          4.91
 31           26.794          5.125
 32           26.062          5.347
 33           25.452          5.562
 34           25.024          5.781
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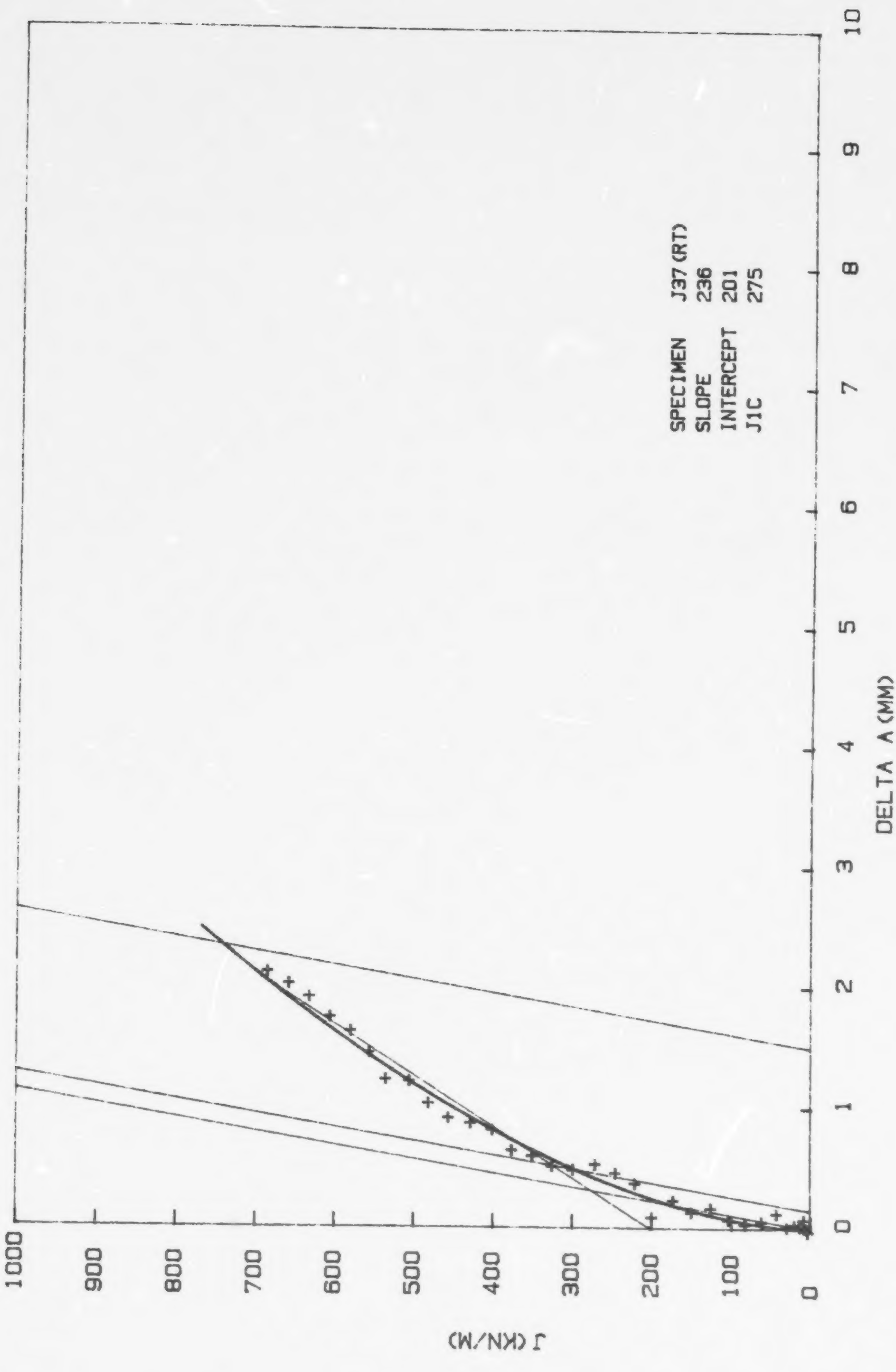
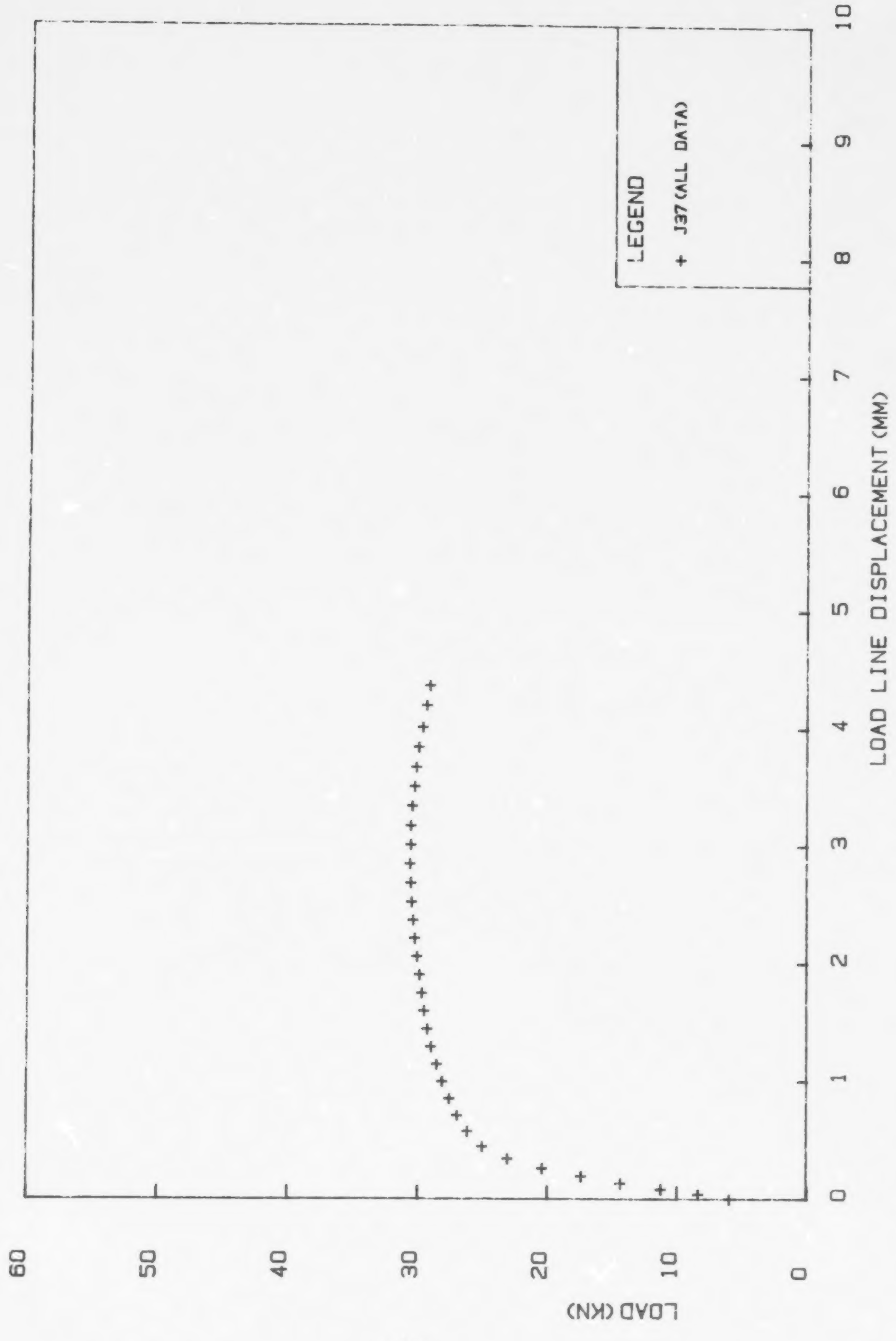
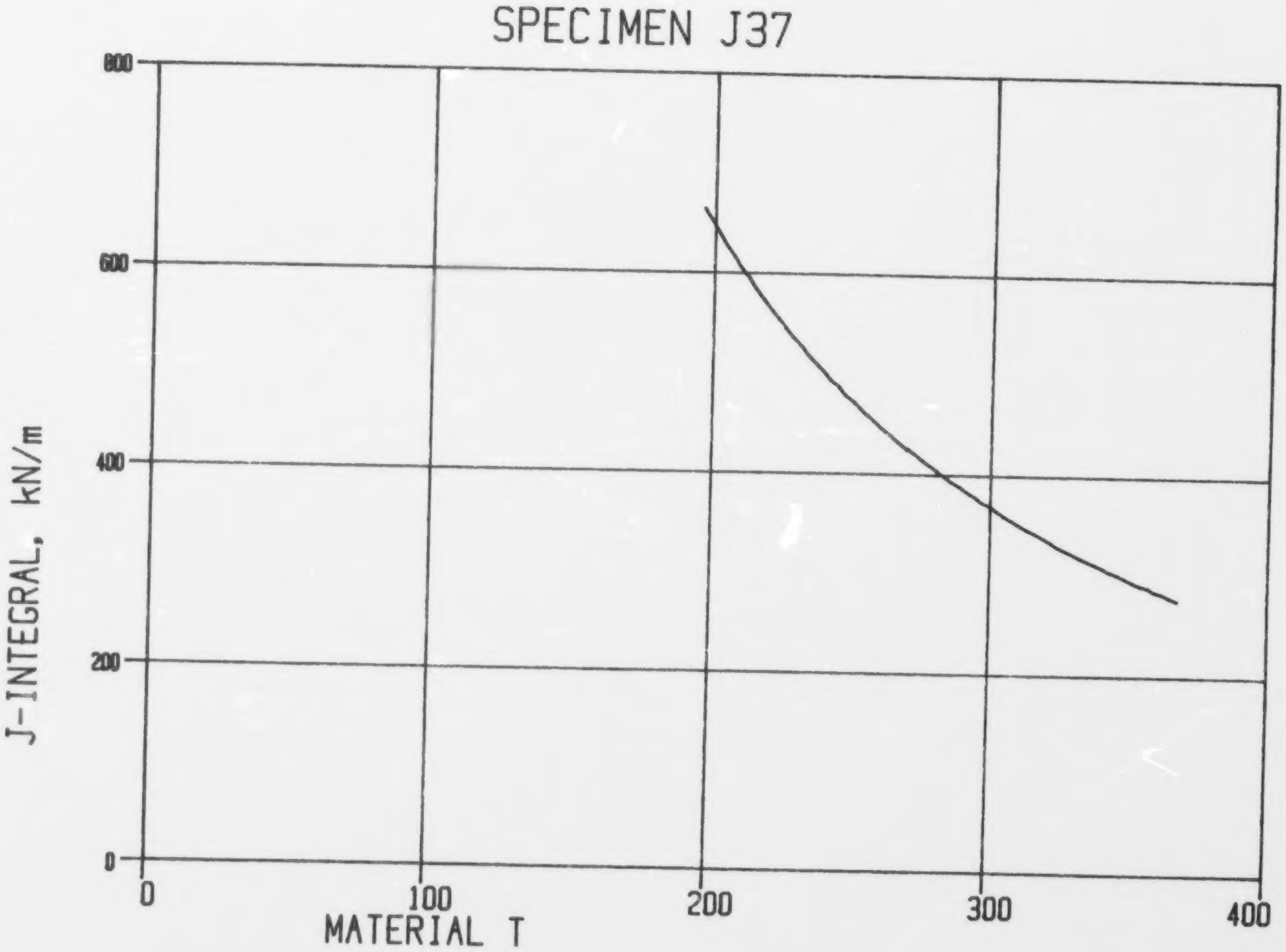

SPECIMEN J37(RT)
SLOPE 236
INTERCEPT 201
J1C 275
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J37 (ALL DATA)


SPECIMEN J37
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J37
MATERIAL TYPE	A106B
MATERIAL CONDITION	HAZ(PN229)
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	367
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	516.1
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	21.417
SPECIMEN WIDTH W(CM)	5.083
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.18972694E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.97
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.132

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.228
INITIAL A/W	.616
AVERAGE CRACK EXTENSION 9PT(CM)	.246
DELTA A(CM) COMPLIANCE	.212
MAX DEVIATION OF SINGLE MEASUREMENT %	5.1

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	16
LAST POINT	33
JIC(KN/M)	275
CORRELATION COEFF	.95
SLOPE M(MPa)	236
INTERCEPT B (KN/M)	201

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	440.67
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	383.96
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.951
25*JQ/EF.Y.(CM)	1.557

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	16
LAST DATA POINT USED	33
CONSTANT(C1)	450.31
EXPONENT(C2)	.583

J37(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
23.95	2.71	.04	2.76	2.76	2.96	3.13	1
32.25	4.92	.17	5.09	5.09	5.45	3.133	2
1.43	8.12	.49	8.61	8.61	9.2	3.14	3
.02	11.84	1.82	13.66	13.66	14.53	3.134	4
.68	16.29	4.06	20.36	20.36	21.55	3.136	5
6.31	20.8	9.32	30.12	30.12	31.65	3.134	6
72.58	24.92	18.55	43.48	43.54	45.26	3.145	7
75.54	27	35.22	62.22	62.2	64.19	3.139	8
77.67	28.54	54.1	82.64	82.56	84.74	3.136	9
79.68	30.03	74.12	104.16	104.22	106.34	3.14	10
81.88	31.72	94.35	126.06	126.58	128.31	3.149	11
82.89	32.5	117.68	150.18	150.48	152.51	3.146	12
84.79	34.02	139.16	173.18	174.24	175.54	3.155	13
84.71	33.95	166.19	200.14	199.9	202.62	3.141	14
87.4	36.14	185.25	221.4	224.26	223.84	3.169	15
88.56	37.1	208.88	245.98	249.89	248.43	3.178	16
89.63	38.01	233.33	271.34	276.25	273.79	3.185	17
89.85	38.2	261.14	299.34	303.55	301.85	3.181	18
90.61	38.84	286.7	325.54	330.24	328.08	3.183	19
91.6	39.7	311.07	350.77	357.08	353.3	3.192	20
92.34	40.34	336.64	376.98	384.29	379.52	3.196	21
93.86	41.68	359.95	401.62	412.82	404.12	3.213	22
94.47	42.22	386.78	429.01	441.53	431.5	3.219	23
94.64	42.38	414.51	456.88	470.6	459.35	3.223	24
95.62	43.25	438.94	482.2	499.33	484.63	3.235	25
96.74	44.28	462.01	506.29	528.96	508.65	3.253	26
96.26	43.84	492.25	536.09	559.14	538.4	3.255	27
97.77	45.22	511.87	557.09	587.84	559.36	3.277	28
98.7	46.09	534.47	580.56	617.65	582.75	3.295	29
98.73	46.11	560.58	606.7	648.26	608.79	3.307	30
99.17	46.53	586.42	632.95	681.12	634.92	3.323	31
99.34	46.68	611.87	658.55	711.37	660.43	3.334	32
98.96	46.33	639.44	685.78	742.9	687.54	3.344	33

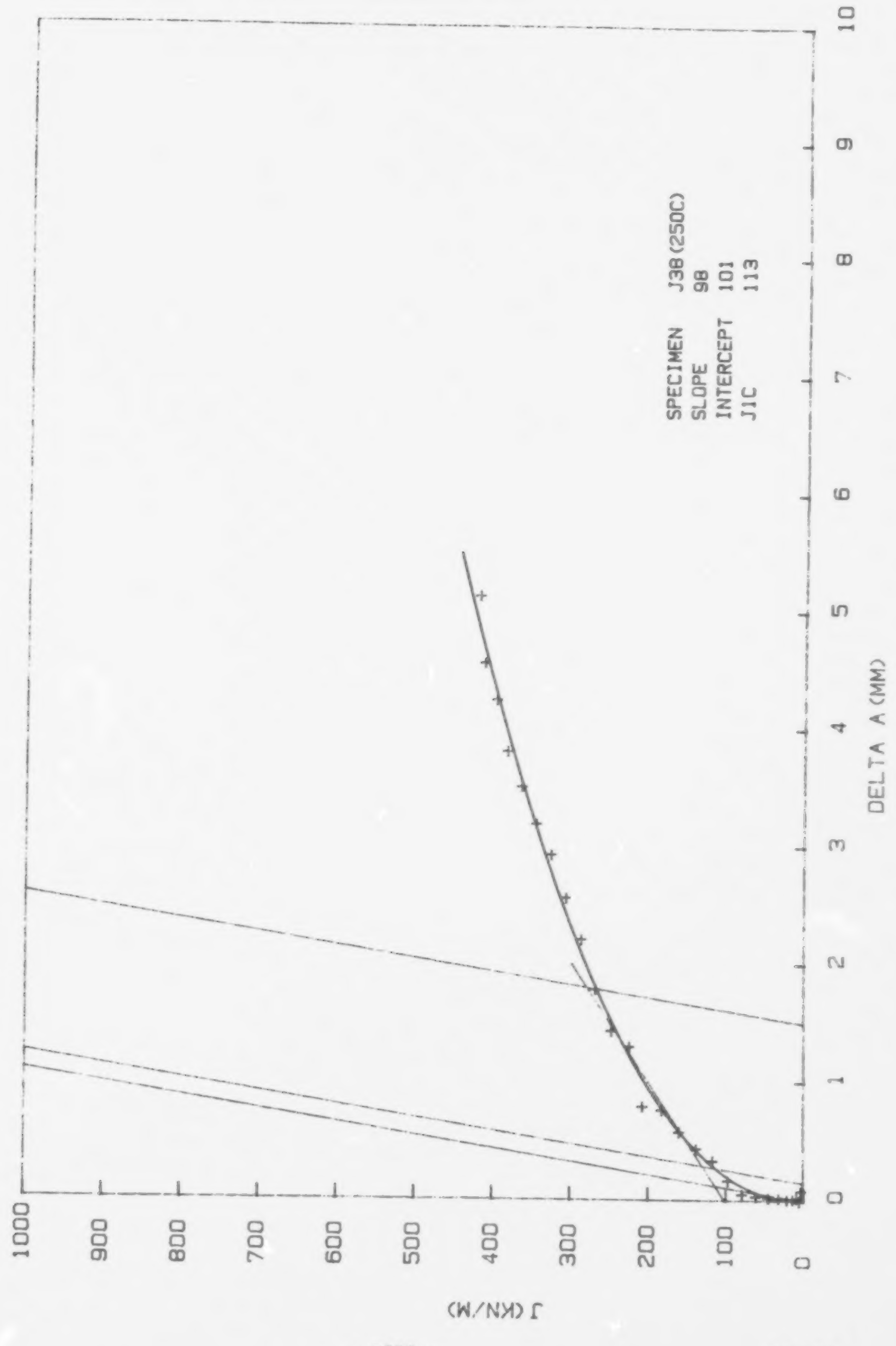
H(M)	D(M)	POISSON´S RATIO
01902	2.54E-03	.3

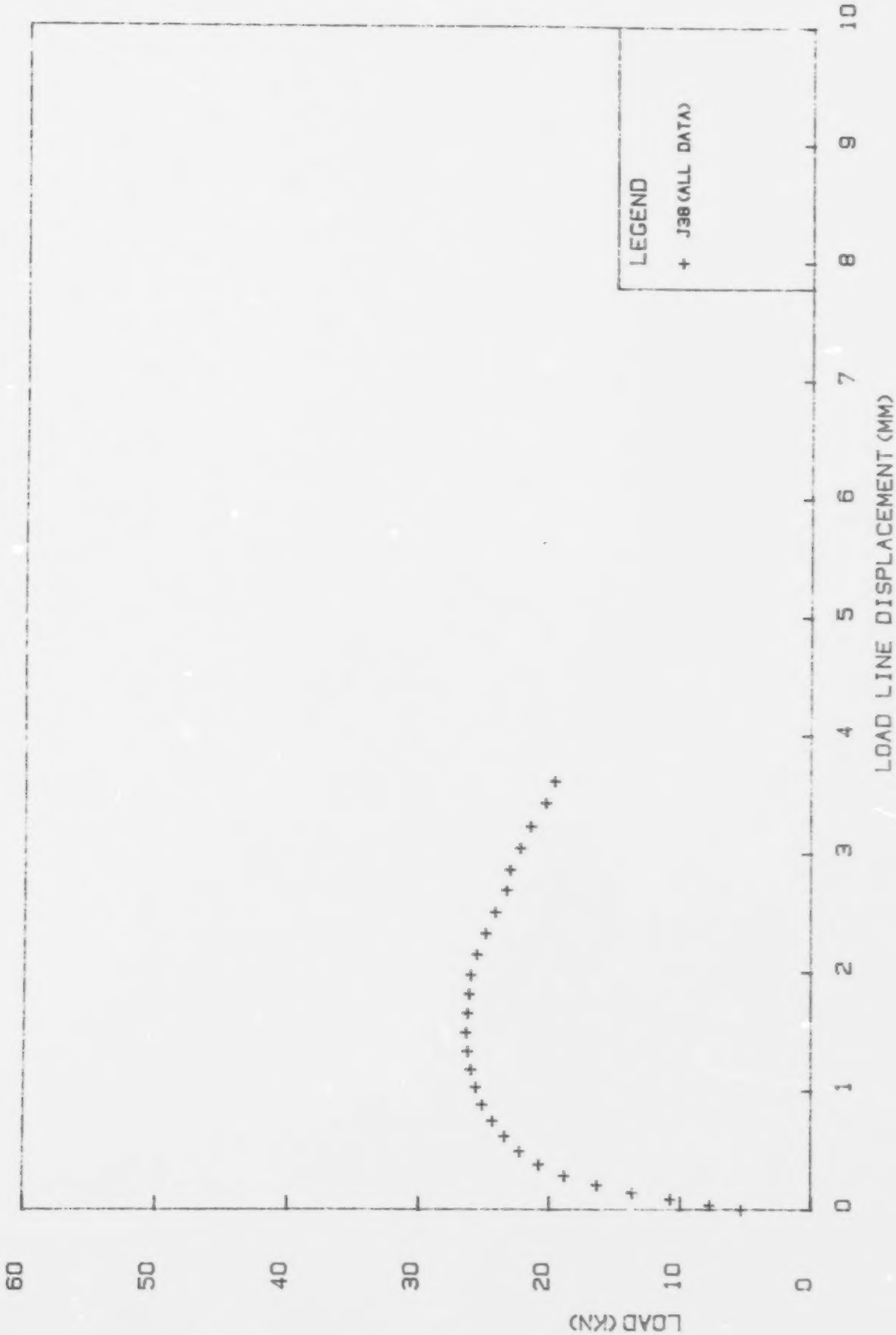
J37

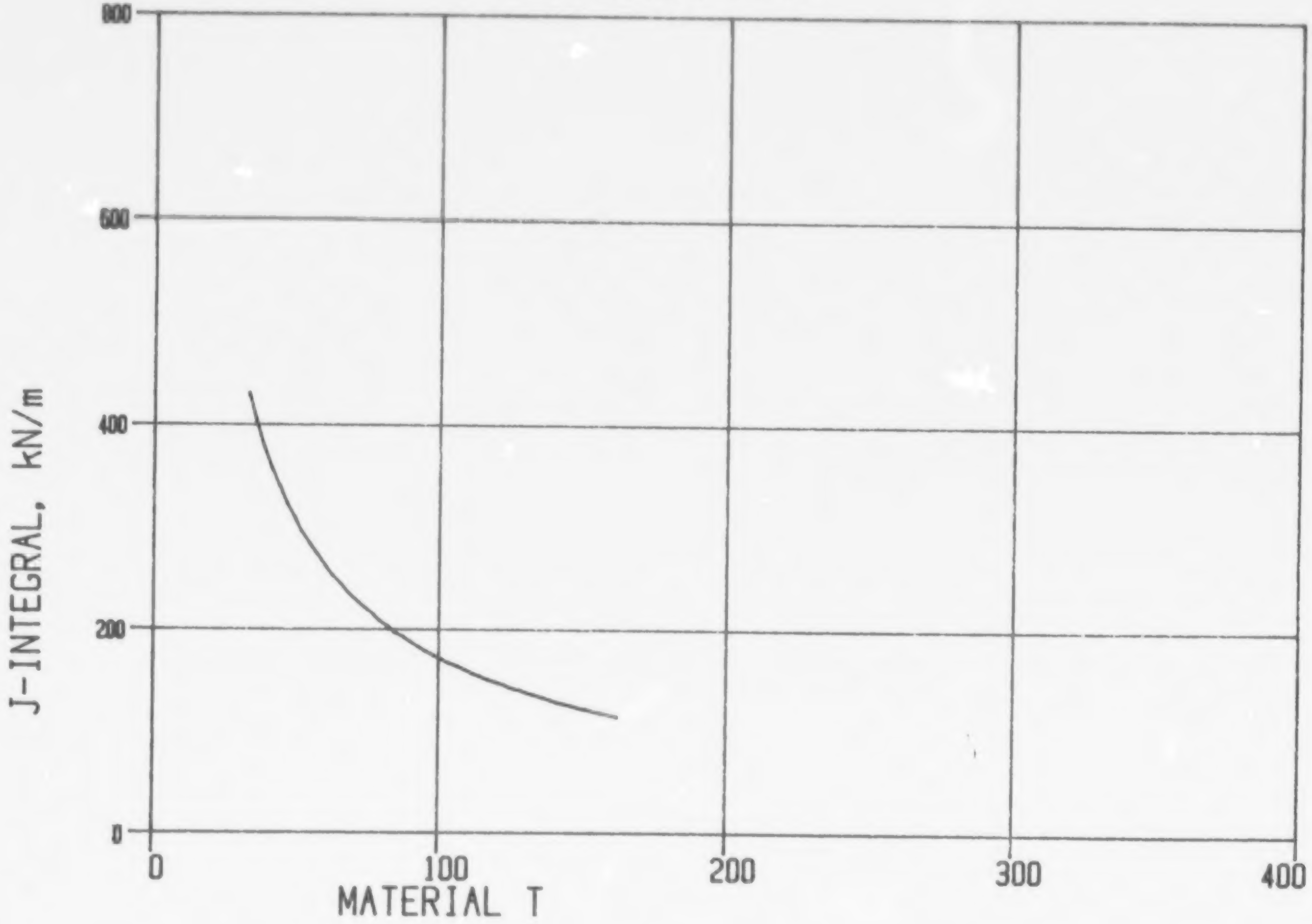
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.76	3.13	3.13	-.022	.9995	1
5.09	3.132	3.133	7E-03	.9999	2
8.61	3.139	3.14	.079	.9999	3
13.66	3.133	3.134	.023	.9999	4
20.36	3.134	3.136	.038	.9999	5
30.12	3.132	3.134	.018	.9999	6
43.48	3.143	3.145	.13	.9999	7
62.22	3.135	3.139	.065	.9999	8
82.64	3.132	3.136	.04	.9999	9
104.16	3.135	3.14	.078	.9999	10
126.06	3.144	3.149	.171	.9999	11
150.18	3.139	3.146	.136	.9999	12
173.18	3.148	3.155	.233	1	13
200.14	3.133	3.141	.093	.9995	14
221.4	3.161	3.169	.374	.9997	15
245.98	3.168	3.178	.458	.9999	16
271.34	3.175	3.185	.529	.9998	17
299.34	3.169	3.181	.485	.9992	18
325.54	3.171	3.183	.513	.9996	19
350.77	3.179	3.192	.596	.9997	20
376.98	3.182	3.196	.643	.9999	21
401.62	3.199	3.213	.813	.9999	22
429.01	3.203	3.219	.867	.9997	23
456.88	3.207	3.223	.912	.9998	24
482.2	3.218	3.235	1.032	.9998	25
506.29	3.235	3.253	1.214	.9999	26
536.09	3.236	3.255	1.226	.9989	27
557.09	3.257	3.277	1.451	.9997	28
580.56	3.274	3.295	1.627	.9997	29
606.7	3.285	3.307	1.745	.9998	30
632.95	3.301	3.323	1.911	.9998	31
658.55	3.311	3.334	2.021	.9998	32
685.78	3.32	3.344	2.118	.9994	33

```
          LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J37
           5.92           0
           8.362           .038
           11.23           .083
    4      14.343          .135
    5      17[illegible]5          .194
    6      20.336          .26
    7      23.071          .342
    8      25.024          .444
    9      26.184          .573
    10     26.978          .708
    11     27.588          .85
    12     28.137          .994
    13     28.564         1.141
    14     28.992         1.289
    15     29.297         1.44
    16     29.541         1.593
    17     29.724         1.746
    18     29.907         1.901
    19     30.09          2.057
    20     30.273         2.211
    21     30.396         2.366
    22     30.518         2.521
    23     30.579         2.686
    24     30.64          2.847
    25     30.579         3.009
    26     30.579         3.171
    27     30.457         3.34
    28     30.273         3.506
    29     30.151         3.671
    30     29.968         3.839
    31     29.663         4.01
    32     29.358         4.196
    33     29.114         4.365
     1     28.748         4.542
```

	J(KN/M)	T	W	J37
1	285.34	-626.86	-42.37	
2	312.44	942.21	58.07	
3	338.16	299.09	16.96	
4	363.88	545.36	28.66	
5	389.3	142.96	6.96	
6	415.32	503.15	22.89	
7	442.95	611.81	26.04	
8	469.54	208.55	8.32	
9	494.25	130.22	4.89	
10	521.19	2436.08	86.62	
11	546.59	92.22	3.09	
12	568.83	131.54	4.19	
13	593.63	218.18	6.62	
14	619.82	156.59	4.51	
15	645.75	228.63	6.28	
16	672.16	275.51	7.23	


SPECIMEN J38(250C)
SLOPE 98
INTERCEPT 101
J1C 113
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J38 (ALL DATA)



SPECIMEN J38

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     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J38
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                HAZ(PN229)
 TEST TEMPERATURE(DEG C)                           250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         364
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       553.7
 CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
 SPECIMEN THICKNESS B(CM)                          2.539
 PERCENT SIDE GROOVE                               21.386
 SPECIMEN WIDTH W(CM)                              5.082
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.82776E+11
 EFFECTIVE MODULUS(Pa)                             1.99849589E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          25.32
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.148

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.221
 INITIAL A/W                                       .619
 AVERAGE CRACK EXTENSION 9PT(CM)                   .534
 DELTA A(CM) COMPLIANCE                            .513
 MAX DEVIATION OF SINGLE MEASUREMENT %             1.76

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                  11
 LAST POINT                   18
 JIC(KN/M)                    113
 CORRELATION COEFF            .94
 SLOPE M(MPa)                 98
 INTERCEPT B (KN/M)           101

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD          YES
 LIGAMENT>25JIC/EFFECTIVE YIELD    YES
 DJ/DA<EFFECTIVE YIELD             YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          NO
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   457.93
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 326.02
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  1.934
 25*JQ/EF.Y.(CM)                                   .616

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       11
 LAST DATA POINT USED      27
 CONSTANT(C1)              204.71
 EXPONENT(C2)              .4554
```

J38

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
[illegible].56	3.156	3.156	.083	.9998	1
06	3.147	3.148	-2E-03	.9999	2
73	3.15	3.15	.024	1	3
3.92	3.148	3.149	.013	1	4
21.49	3.148	3.149	.012	.9999	5
31.99	3.148	3.15	.023	.9999	6
45.43	3.148	3.151	.026	1	7
61.61	3.148	3.152	.037	.9999	8
79.18	3.15	3.154	.056	1	9
97.48	3.16	3.165	.17	.9998	10
117.47	3.176	3.182	.336	.9999	11
138.52	3.186	3.192	.439	1	12
160.33	3.199	3.206	.58	.9999	13
182.47	3.217	3.224	.764	.9999	14
207.31	3.219	3.227	.795	.9994	15
224.39	3.269	3.278	1.302	1	16
247.4	3.282	3.292	1.436	.9999	17
268.19	3.316	3.327	1.787	.9988	18
286.92	3.358	3.369	2.21	.9999	19
306.96	3.392	3.404	2.562	.9999	20
326.33	3.429	3.441	2.93	.9999	21
345.82	3.454	3.467	3.189	.9999	22
364.78	3.485	3.499	3.506	.9999	23
383.4	3.514	3.528	3.805	.9999	24
398	3.558	3.572	4.24	.9998	25
413.36	3.589	3.604	4.557	.999	26
420.21	3.646	3.661	5.129	.9999	27

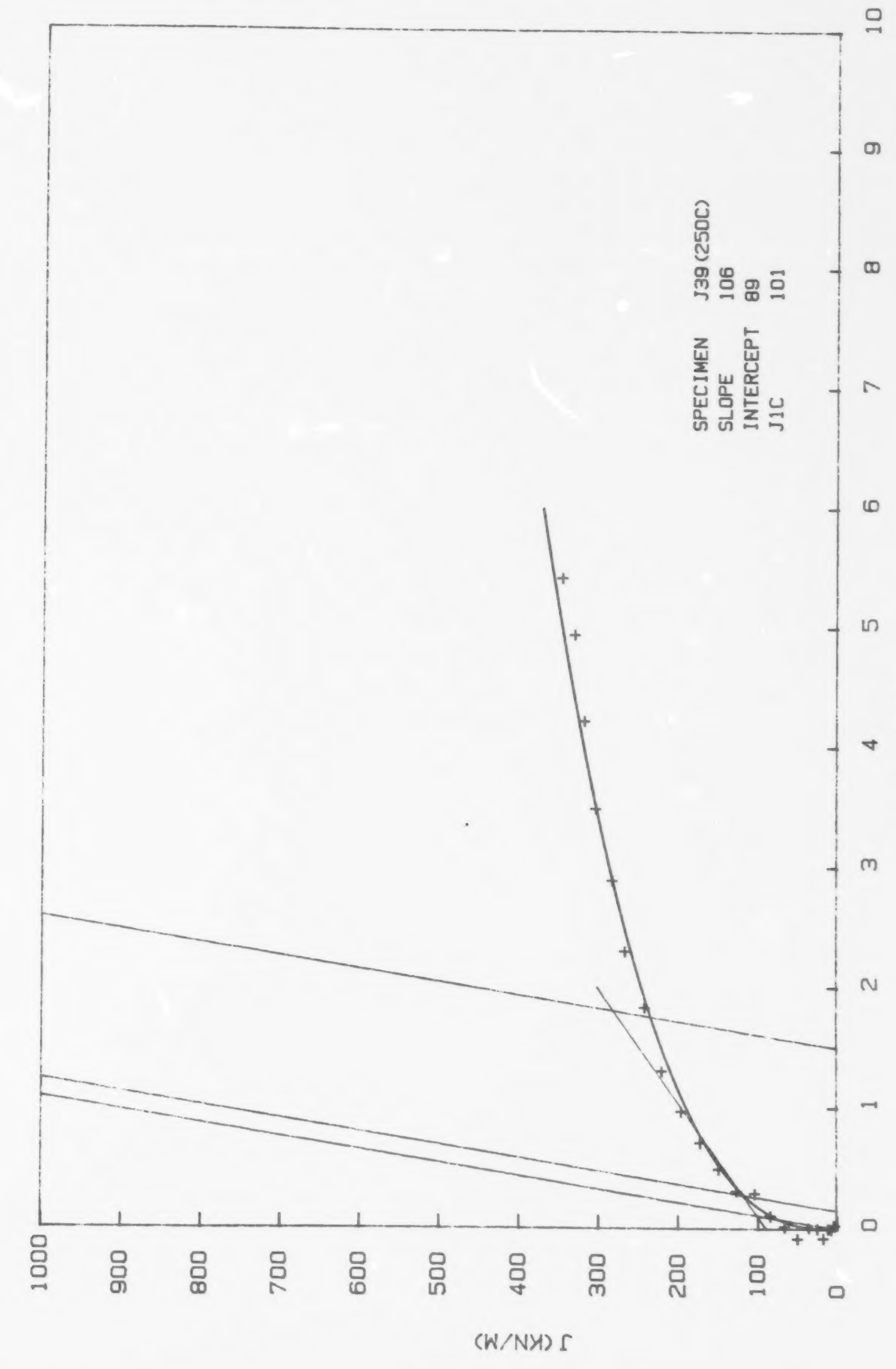
J38(250C)

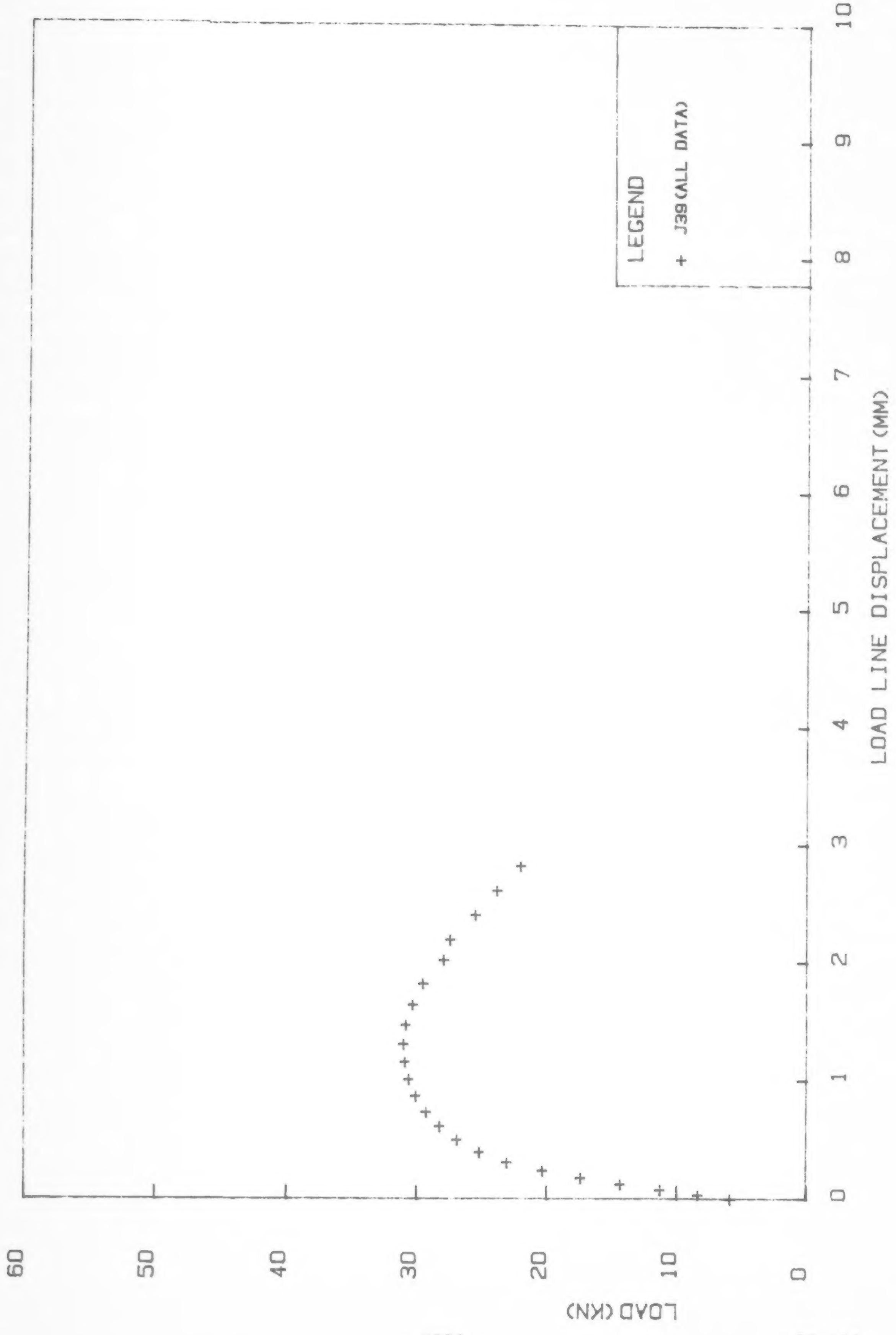
K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.71	2.57	0	2.56	2.56	2.73	3.156	1
31.25	4.86	.2	5.06	5.06	5.41	3.148	2
39.86	7.91	.82	8.73	8.73	9.29	3.15	3
47.65	11.3	2.62	13.92	13.92	14.74	3.149	4
54.93	15.02	6.47	21.49	21.49	22.58	3.149	5
60.68	18.33	13.66	31.99	31.99	33.32	3.15	6
64.96	21.01	24.42	45.43	45.44	46.96	3.151	7
68.41	23.3	38.31	61.61	61.63	63.3	3.152	8
71.19	25.23	53.95	79.18	79.26	81	3.154	9
74.2	27.41	70.07	97.48	97.97	99.39	3.165	10
76.68	29.27	88.2	117.47	118.73	119.41	3.182	11
78.45	30.64	107.88	138.52	140.4	140.48	3.192	12
80.13	31.96	128.37	160.33	163.24	162.29	3.206	13
81.76	33.29	149.19	182.47	187	184.38	3.224	14
81.6	33.15	174.16	207.31	212.14	209.18	3.227	15
84.87	35.86	188.53	224.39	235.31	226.15	3.278	16
85.47	36.37	211.03	247.4	260.09	249.09	3.292	17
86.54	37.29	230.9	268.19	286.13	269.68	3.327	18
87.59	38.2	248.72	286.92	311.88	288.19	3.369	19
87.87	38.44	268.51	306.96	338.34	307.97	3.404	20
87.8	38.38	287.94	326.33	365.08	327.06	3.441	21
89.12	39.55	306.27	345.82	390.25	346.45	3.467	22
88.81	39.27	325.51	364.78	416.67	365.16	3.499	23
88.29	38.81	344.59	383.4	442.88	383.52	3.528	24
87.39	38.02	359.97	398	469.38	397.82	3.572	25
87.41	38.04	375.32	413.36	494.01	413	3.604	26
87.6	38.21	382	420.21	518.59	419.76	3.661	27

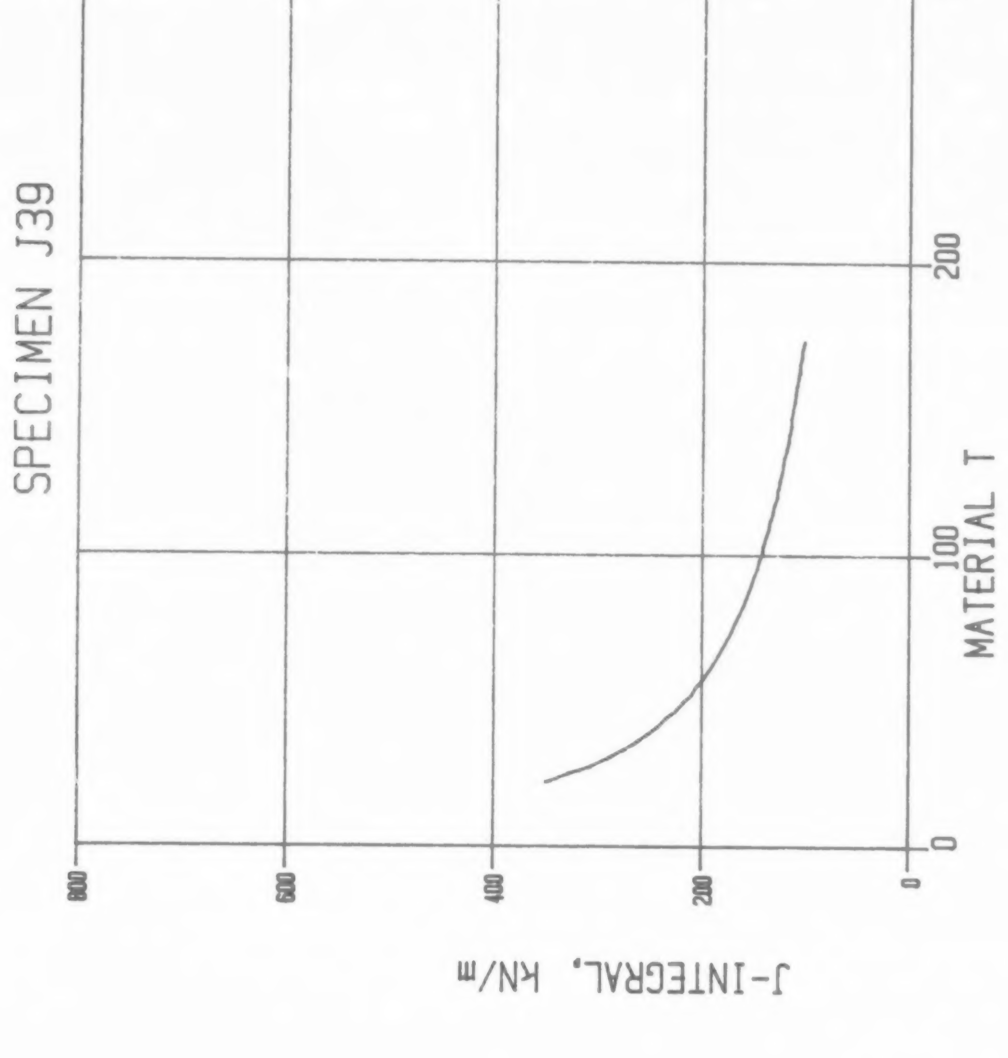
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

```
              LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J38
               5.31           0
               7.751           .039
               10.742          .089
               13.672          .145
 5             16.357          .209
 6             18.86           .287
 7             20.813          .382
 8             22.278          .493
 9             23.438          .619
 10            24.353          .75
 11            25.146          .885
 12            25.635          1.031
 13            26.001          1.179
 14            26.245          1.333
 15            26.367          1.492
 16            26.245          1.654
 17            26.123          1.816
 18            26.001          1.976
 19            25.513          2.151
 20            24.841          2.327
 21            24.109          2.506
 22            23.254          2.69
 23            23.01           2.863
 24            22.217          3.046
 25            21.423          3.23
 26            20.264          3.427
 27            19.592          3.61
 28            18.433          3.809
```

	J(KN/M)	T	W	J38
1	107.48	104.88	21.36	
2	128	176.08	29.95	
3	149.43	134.49	19.45	
4	171.4	104.32	13.02	
5	194.89	706.74	77.47	
6	215.85	29.22	2.81	
7	235.89	149.99	13.11	
8	257.79	51.38	4.03	
9	277.56	38.47	2.74	
10	296.94	49.37	3.21	
11	316.64	45.71	2.73	
12	336.07	65.13	3.61	
13	355.3	51.99	2.67	
14	374.09	54.11	2.59	
15	390.7	29.11	1.3	
16	405.68	42.08	1.77	
17	416.79	10.39	.41	


SPECIMEN J39(250C)
SLOPE 106
INTERCEPT 89
J1C 101
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J39(ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J39
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

```
      DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

 SPECIMEN NUMBER                                       J39
 MATERIAL TYPE                                         A106B
 MATERIAL CONDITION                                    HAZ(PN229)
 TEST TEMPERATURE(DEG C)                               250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             364
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           553.7
 CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
 SPECIMEN THICKNESS B(CM)                              2.54
 PERCENT SIDE GROOVE                                   20.905
 SPECIMEN WIDTH W(CM)                                  5.085
 YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
 EFFECTIVE MODULUS(Pa)                                 1.9626792E+11

                FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              22.63
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                   3.006

                CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                        3.063
 INITIAL A/W                                           .591
 AVERAGE CRACK EXTENSION 9PT(CM)                       .568
 DELTA A(CM) COMPLIANCE                                .541
 MAX DEVIATION OF SINGLE MEASUREMENT %                 1.57

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     11
 LAST POINT                      16
 JIC(KN/M)                       101
 CORRELATION COEFF               .95
 SLOPE M(MPa)                    106
 INTERCEPT B (KN/M)              89

                VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD           YES

                QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                              NO
 CRACK SIZE DA<0.15*DELTA A                            YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       460.91
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     352.77
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.079
 25*JQ/EF.Y.(CM)                                       .55

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        11
 LAST DATA POINT USED       23
 CONSTANT(C1)               190.14
 EXPONENT(C2)               .3753
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          J39(250C)

K          J-ELASTIC     J-PLASTIC    JEL+JPL      J(M)        J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)        (KN/M)       (KN/M)      (KN/M)         (KN/M)        (CM)

21.71       2.35          .01          2.36        2.36          2.5       3.009  1
29.32       4.28          .18          4.46        4.46          4.73      3.009  2
37.15       6.87          .76          7.63        7.63          8.07      3.006  3
45.07       10.11         1.62         11.73       11.73         12.37     3.006  4
52.34       13.64         4.05         17.69       17.68         18.57     2.998  5
59.78       17.79         7.49         25.28       25.29         26.41     3.006  6
65.35       21.26         14.87        36.13       36.15         37.48     3.007  7
69.3        23.91         26.49        50.4        50.33         51.95     2.998  8
73.3        26.75         39.79        66.55       66.64         68.23     3.008  9
76.51       29.14         55.62        84.76       85.08         86.56     3.017  10
79.69       31.62         72.67        104.29      105.26        106.15    3.035  11
81.26       32.88         94.28        127.15      128.2         129.09    3.037  12
83.22       34.48         115.14       149.62      151.76        151.55    3.055  13
84.98       35.95         136.63       172.59      176.35        174.48    3.077  14
86.22       37.01         159.59       196.61      202.66        198.39    3.103  15
87          37.69         183.47       221.16      230.72        222.74    3.137  16
88.47       38.97         203.61       242.57      258.55        243.9     3.189  17
87.08       37.75         229.71       267.46      289.86        268.31    3.236  18
90.07       40.39         243.21       283.6       315.37        284.35    3.295  19
88.3        38.82         265.83       304.66      346.71        304.85    3.355  20
88.48       38.98         280.2        319.18      375.38        319.02    3.428  21
87.69       38.29         293.47       331.76      403.15        331.26    3.5    22
86.44       37.2          310.46       347.66      429.91        346.81    3.547  23

H(M)              D(M)            POISSON'S RATIO
.01902            2.54E-03        .3
```

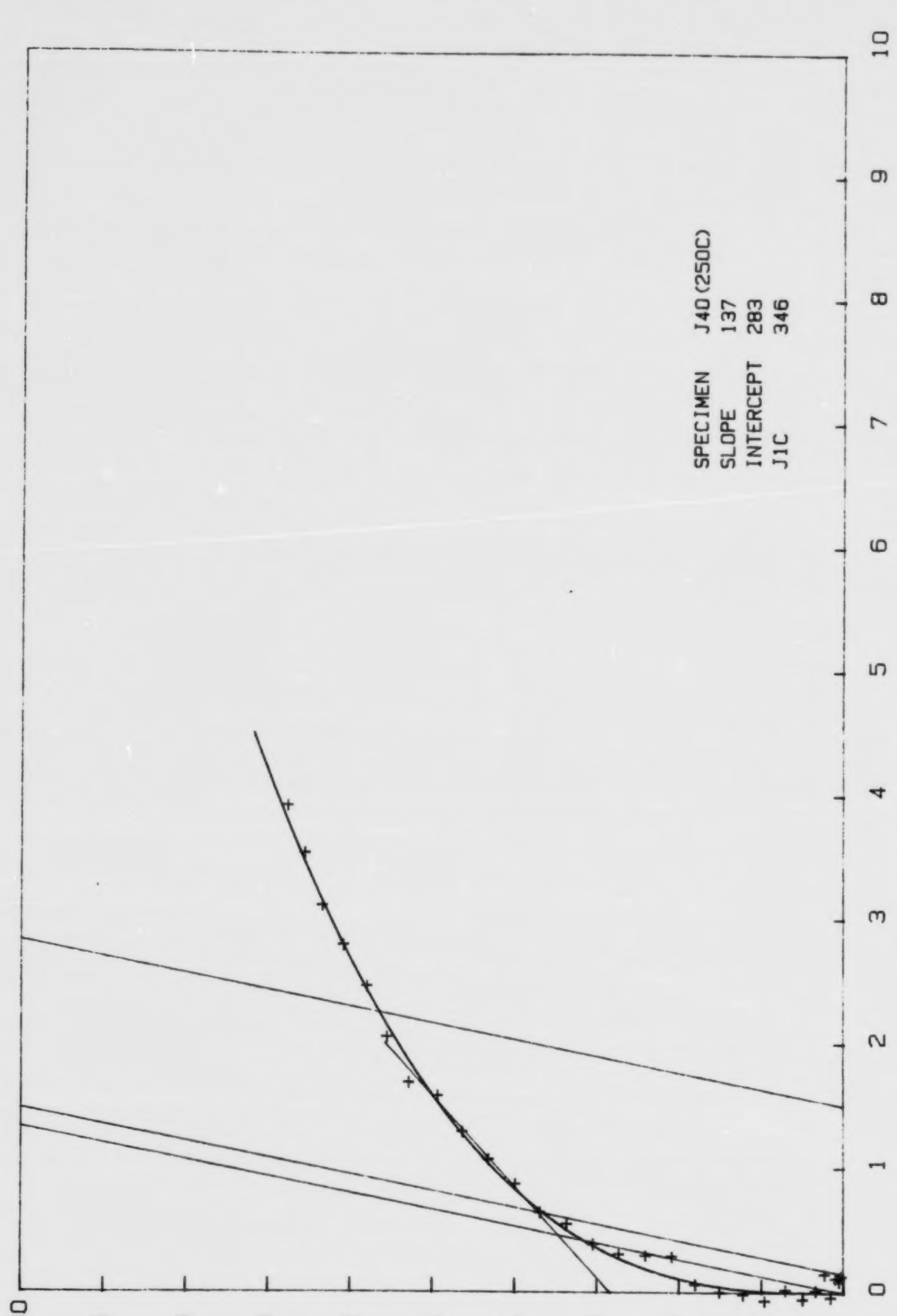
J39

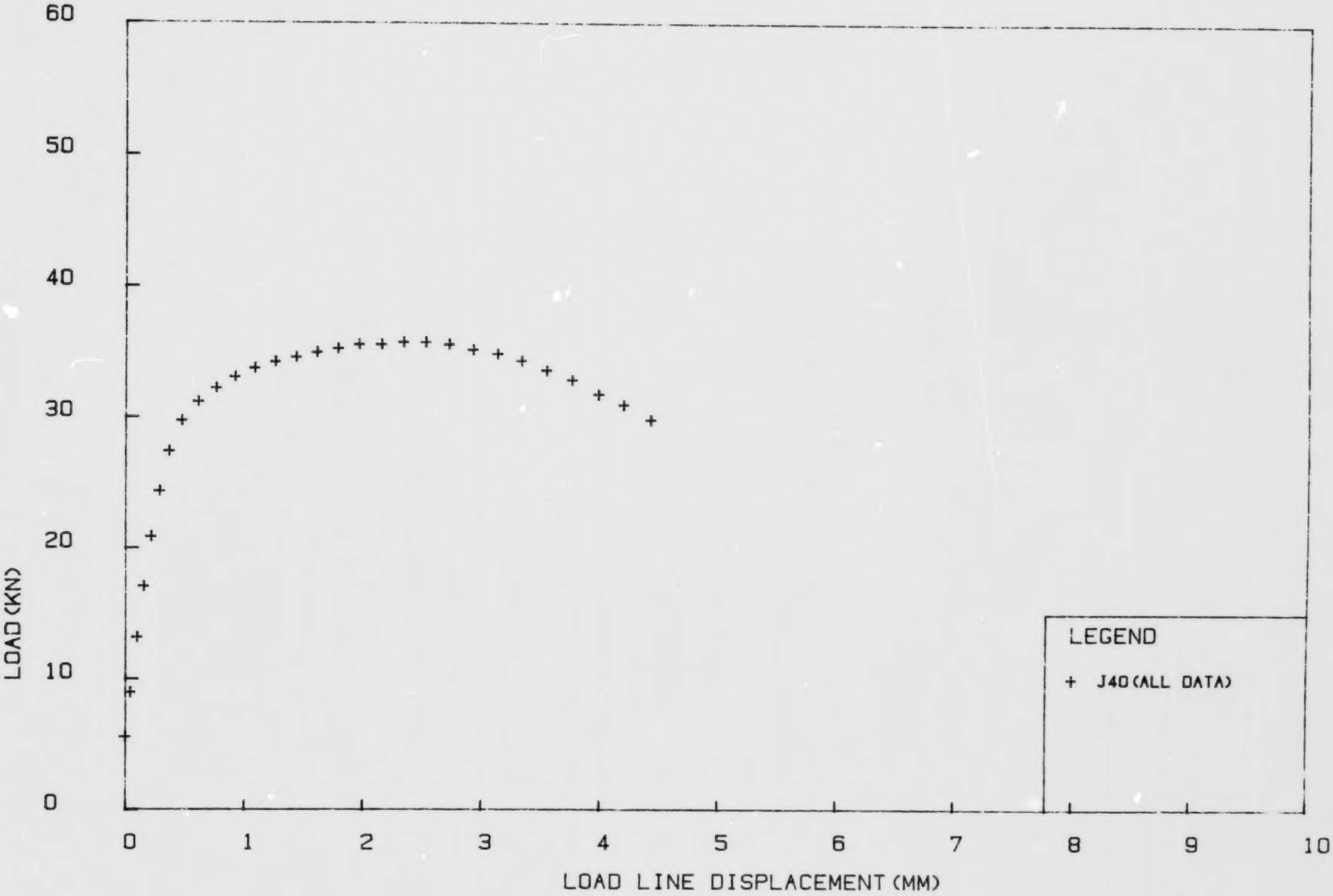
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.36	3.009	3.009	.032	.9987	1
4.46	3.009	3.009	.032	.9996	2
7.63	3.005	3.006	-2E-03	.9999	3
11.73	3.005	3.006	3E-03	.9996	4
17.69	2.997	2.998	-.077	.9996	5
25.28	3.005	3.006	5E-03	.9999	6
36.13	3.005	3.007	.012	.9999	7
50.4	2.995	2.998	-.08	.9999	8
66.55	3.004	3.008	.02	.9999	9
84.76	3.013	3.017	.109	.9999	10
104.29	3.03	3.035	.293	.9996	11
127.15	3.031	3.037	.311	.9998	12
149.62	3.049	3.055	.493	.9998	13
172.59	3.07	3.077	.711	.9998	14
196.61	3.095	3.103	.97	.9999	15
221.16	3.127	3.137	1.307	.9999	16
242.57	3.18	3.189	1.834	.9999	17
267.46	3.225	3.236	2.301	.9998	18
283.6	3.284	3.295	2.891	.9999	19
304.66	3.343	3.355	3.489	.9997	20
319.18	3.416	3.428	4.22	.9995	21
331.76	3.488	3.5	4.94	.9997	22
347.66	3.534	3.547	5.414	.9978	23

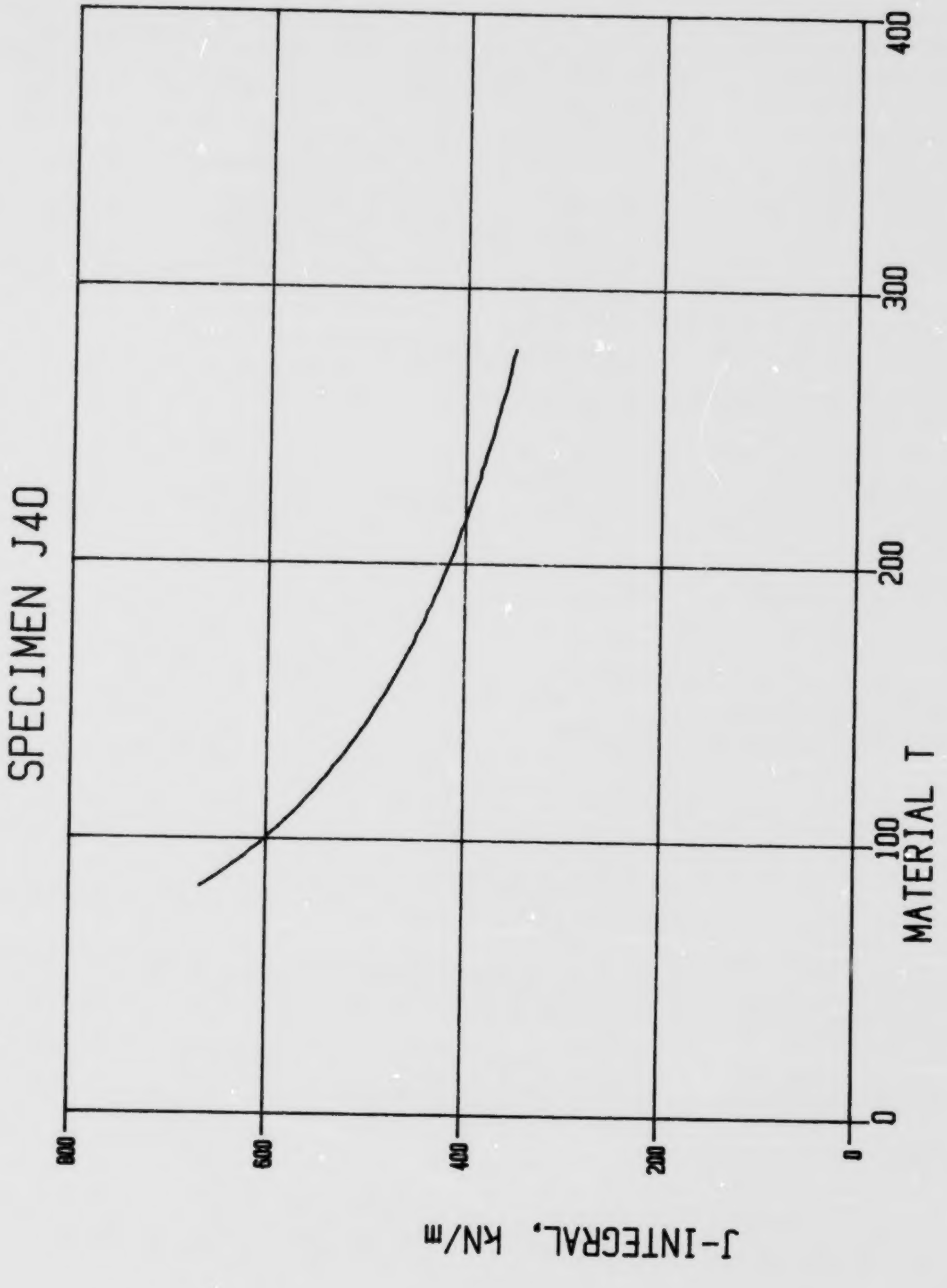
```
      J(KN/M)              T              W       J39

1        94.53         91.86            22.94
2        115.72        1105.71          225.4
3        138.38        107.68           18.19
4        161.1         91.19            13.09
5        184.6         80.41            9.94
6        208.88        63.34            6.81
7        231.87        35.27            3.32
8        255.02        46.32            3.87
9        275.53        23.74            1.78
10       294.13        30.58            2.07
11       311.92        17.24            1.06
12       325.47        15.16            .85
13       339.71        29.14            1.52
```

```
             LOAD(KN)       LOAD LINE DISPLACEMENT(MM)        J39
  1            5.859          0
  2            8.362           .034
  3            11.292          .077
  4            14.343          .126
  5            17.395          .177
  6            20.325          .238
  7            23.071          .308
  8            25.208          .394
  9            26.917          .497
  10           28.259          .612
  11           29.297          .735
  12           30.09           .867
  13           30.64           1.008
  14           30.945          1.155
  15           31.067          1.306
  16           30.884          1.467
  17           30.334          1.641
  18           29.541          1.819
  19           27.954          2.019
  20           27.466          2.191
  21           25.513          2.402
  22           23.865          2.61
  23           22.034          2.819
  24           20.691          3.018
```


SPECIMEN J40(250C)
SLOPE 137
INTERCEPT 283
J1C 346
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J40 (ALL DATA)



SPECIMEN J40

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                      J40
  MATERIAL TYPE                                        A106B
  MATERIAL CONDITION                                   WELD(PN108)
  TEST TEMPERATURE(DEG C)                              250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            273
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          479.8
  CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
  SPECIMEN THICKNESS B(CM)                             2.538
  PERCENT SIDE GROOVE                                  21.118
  SPECIMEN WIDTH W(CM)                                 5.091
  YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
  EFFECTIVE MODULUS(Pa)                                1.99575399E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             21.7
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                  2.952

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                       3.035
  INITIAL A/W                                          .58
  AVERAGE CRACK EXTENSION 9PT(CM)                      .42
  DELTA A(CM) COMPLIANCE                               .391
  MAX DEVIATION OF SINGLE MEASUREMENT %                .39

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                    18
  LAST POINT                     24
  JIC(KN/M)                      346
  CORRELATION COEFF              .99
  SLOPE M(MPa)                   137
  INTERCEPT B (KN/M)             283

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD       NO
  LIGAMENT>25JIC/EFFECTIVE YIELD NO
  DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                             NO
  CRACK SIZE DA<0.15*DELTA A                           YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      376.78
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    328.95
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.139
  25*JQ/EF.Y.(CM)                                      2.298

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       18
  LAST DATA POINT USED      29
  CONSTANT(C1)              426.66
  EXPONENT(C2)              .3462
```

J40(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.52	2.53	.01	2.53	2.53	2.65	2.965	1
32.99	5.42	.18	5.6	5.6	5.91	2.961	2
42.85	9.14	.64	9.78	9.78	10.31	2.964	3
51.75	13.33	2.36	15.69	15.69	16.5	2.948	4
61.21	18.65	4.75	23.4	23.42	24.5	2.967	5
68.22	23.17	11.08	34.25	34.24	35.66	2.954	6
73.61	26.98	23.16	50.14	50.07	51.81	2.947	7
77.68	30.04	41.14	71.18	71.22	72.99	2.955	8
79.74	31.66	64.8	96.46	96.28	98.43	2.946	9
82.16	33.61	88.74	122.35	122.38	124.41	2.951	10
83.94	35.08	115.76	150.84	150.96	152.97	2.953	11
85.54	36.43	143.8	180.23	180.79	182.39	2.959	12
87.89	38.46	170.31	208.77	211.32	210.89	2.981	13
88.87	39.32	201.38	240.7	243.32	242.87	2.982	14
89.72	40.08	232.79	272.87	275.64	275.07	2.983	15
91.03	41.26	263.23	304.48	308.41	306.7	2.991	16
92.12	42.25	294.16	336.41	342.95	338.55	3.007	17
93.25	43.3	326.02	369.32	377.61	371.45	3.016	18
94.87	44.81	354.58	399.39	412.34	401.45	3.039	19
95.83	45.73	386.19	431.91	449.34	433.85	3.059	20
96.33	46.2	417.59	463.79	486.71	465.56	3.081	21
97.68	47.5	446.4	493.9	524.6	495.52	3.11	22
96.97	46.81	482.4	529.21	563.05	530.68	3.12	23
97.73	47.56	508.41	555.97	601.38	557.21	3.157	24
98.88	48.68	531.69	580.37	639.64	581.42	3.198	25
98.26	48.07	560.69	608.77	679.91	609.49	3.231	26
98.45	48.25	586.22	634.47	717.82	634.96	3.263	27
98.36	48.17	607.76	655.93	756.63	656.15	3.305	28
98.45	48.25	628.42	676.67	793.79	676.67	3.343	29

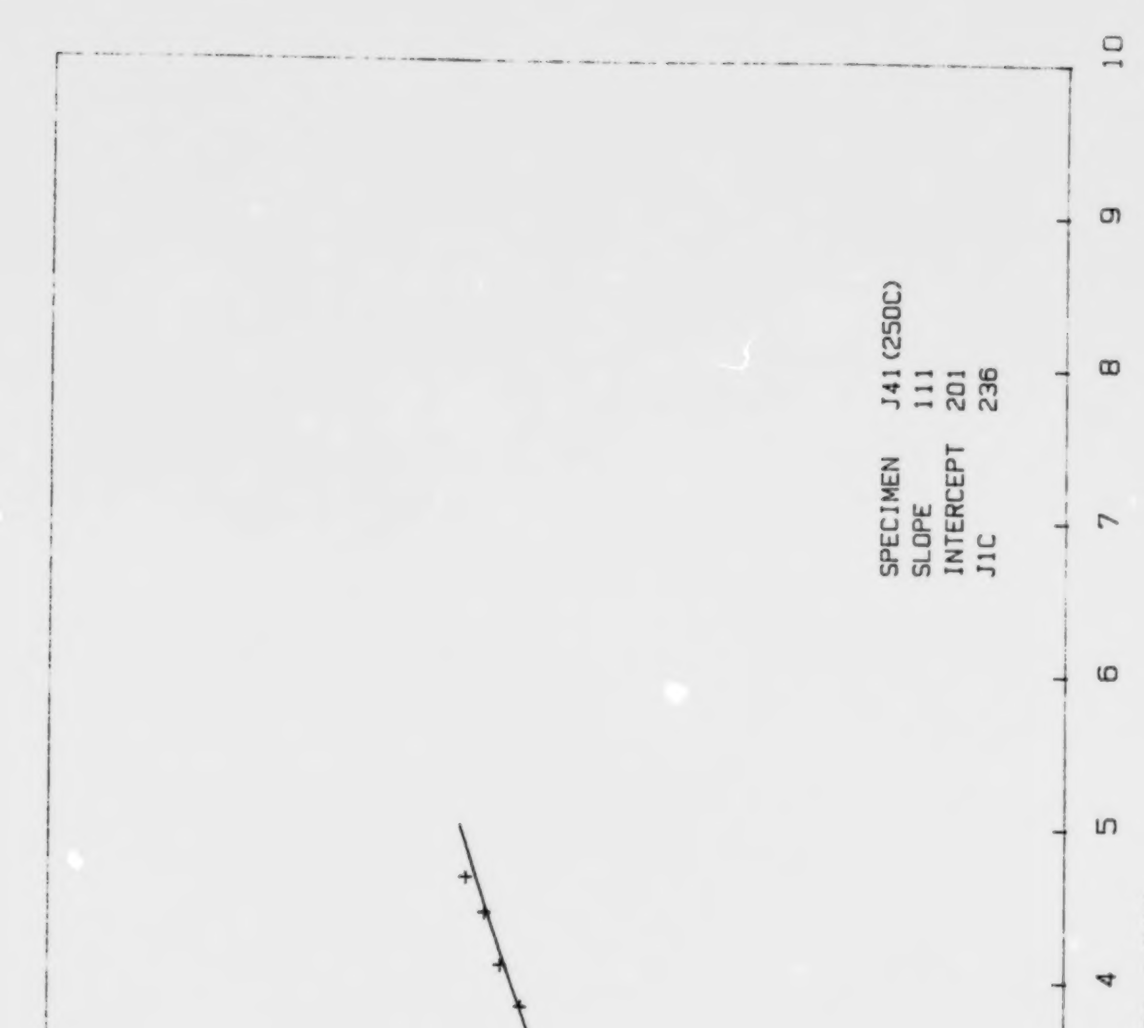
H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

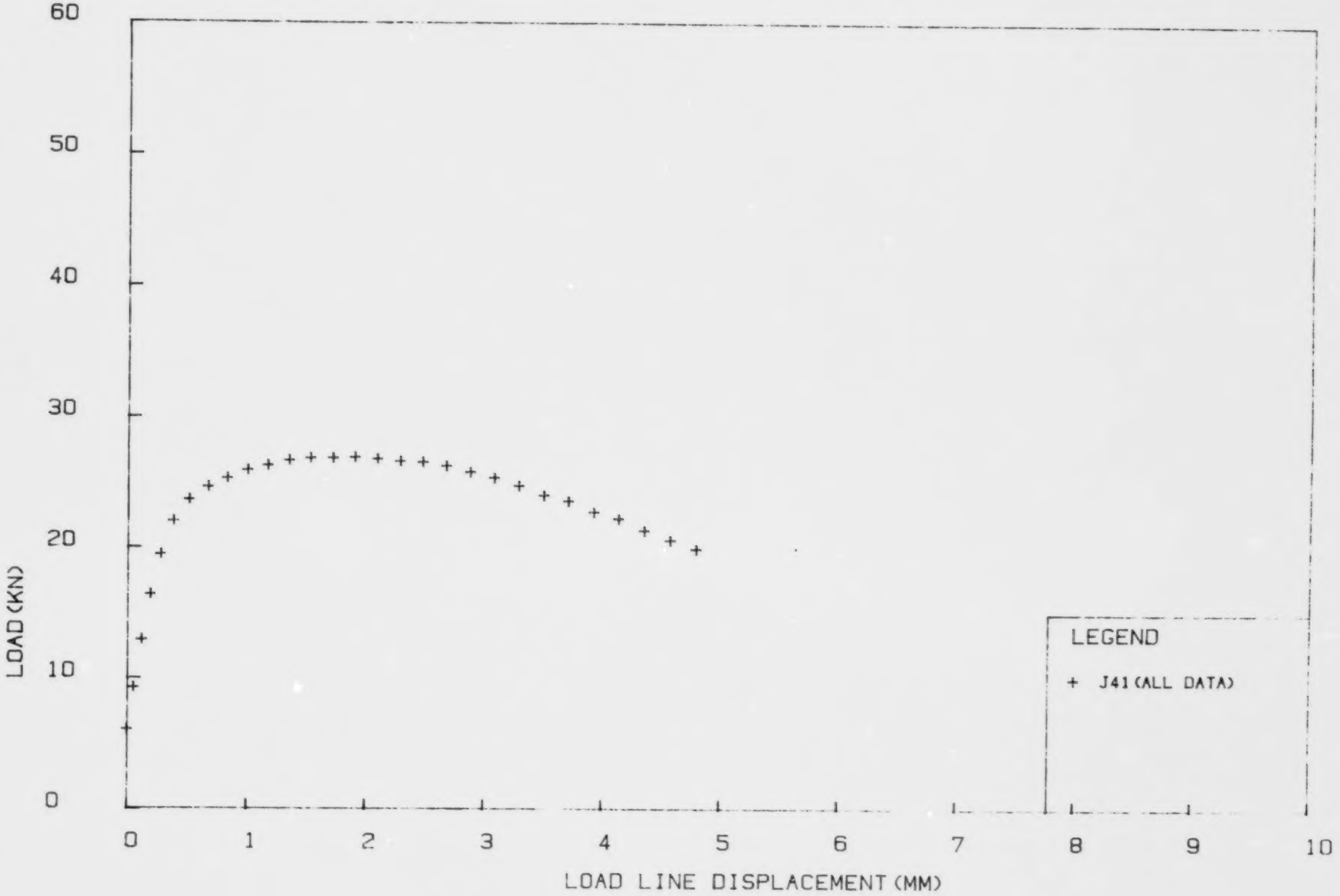
J40

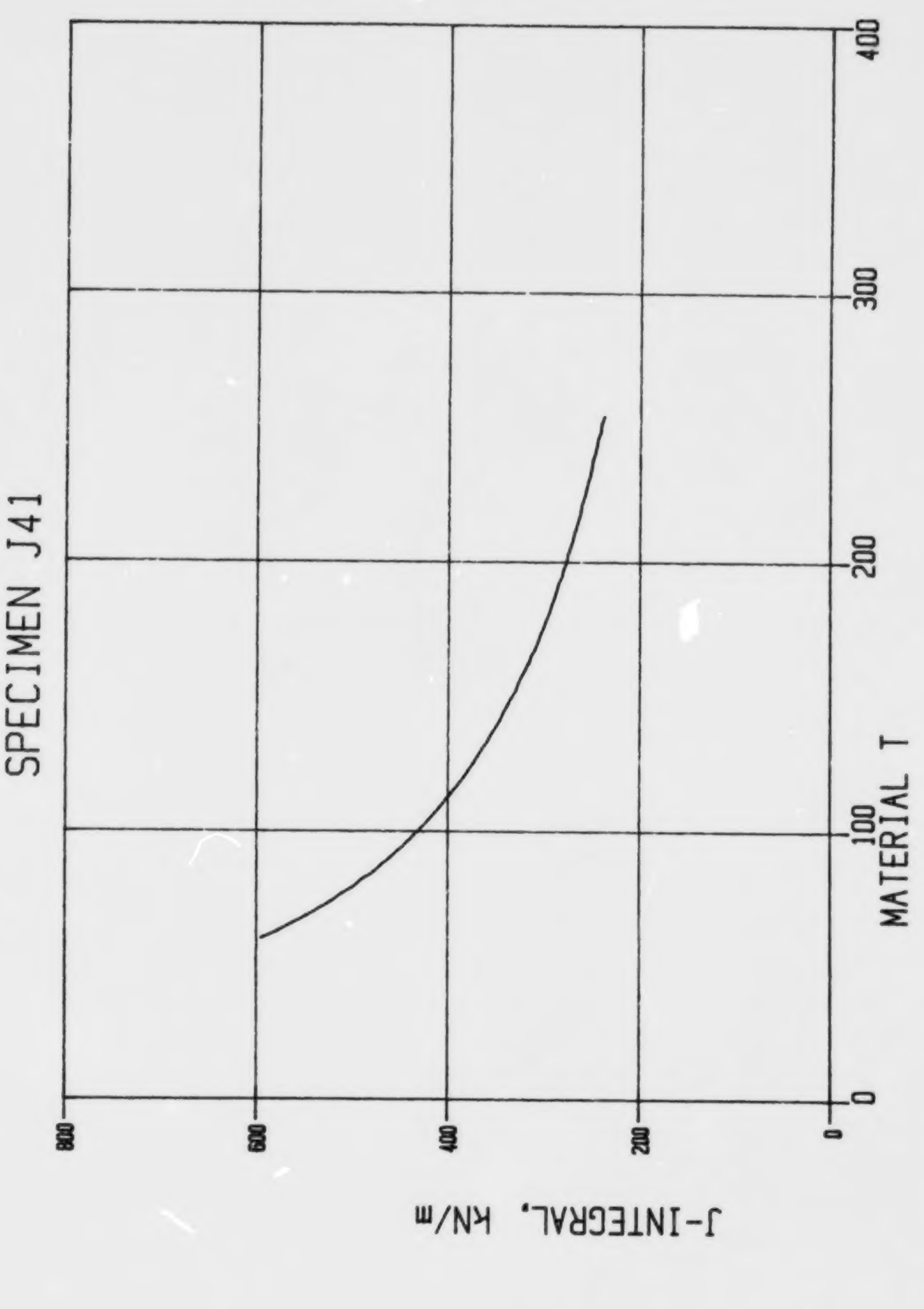
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.53	2.965	2.965	.134	.9994	1
5.6	2.961	2.961	.091	.9999	2
9.78	2.963	2.964	.117	.9999	3
15.69	2.947	2.948	-.037	.9996	4
23.4	2.965	2.967	.15	.9998	5
34.25	2.952	2.954	.019	.9999	6
50.14	2.944	2.947	-.052	.9999	7
71.18	2.951	2.955	.025	.9999	8
96.46	2.941	2.946	-.064	1	9
122.35	2.945	2.951	-.013	.9999	10
150.84	2.946	2.953	6E-03	.9998	11
180.23	2.951	2.959	.067	.9997	12
208.77	2.972	2.981	.291	.9999	13
240.7	2.972	2.982	.298	.9998	14
272.87	2.972	2.983	.309	.9999	15
304.48	2.979	2.991	.389	.9998	16
336.41	2.993	3.007	.548	.9999	17
369.32	3.002	3.016	.642	.9999	18
399.39	3.023	3.039	.869	.9998	19
431.91	3.042	3.059	1.067	.9997	20
463.79	3.063	3.081	1.289	.9999	21
493.9	3.091	3.11	1.577	.9999	22
529.21	3.101	3.12	1.684	.9998	23
555.97	3.136	3.157	2.05	.9998	24
580.37	3.176	3.198	2.459	.9998	25
608.77	3.208	3.231	2.788	.9998	26
634.47	3.239	3.263	3.105	.9999	27
655.93	3.281	3.305	3.531	.9999	28
676.67	3.319	3.343	3.911	.9998	29

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J40
1	5.554	0	
2	8.972	.044	
3	13.184	.1	
4	17.09	.156	
5	20.874	.217	
6	24.353	.288	
7	27.405	.369	
8	29.724	.476	
9	31.189	.613	
10	32.227	.764	
11	33.081	.92	
12	33.752	1.086	
13	34.241	1.257	
14	34.607	1.433	
15	34.973	1.609	
16	35.278	1.785	
17	35.583	1.963	
18	35.583	2.151	
19	35.767	2.336	
20	35.767	2.524	
21	35.583	2.722	
22	35.156	2.922	
23	34.851	3.127	
24	34.302	3.33	
25	33.569	3.542	
26	32.837	3.757	
27	31.738	3.982	
28	30.945	4.197	
29	29.785	4.424	
30	28.809	4.644	

	J(KN/M)	T	W	J40
1	352.86	449.44	20.48	
2	384.36	171.25	7.09	
3	415.65	211.24	8.01	
4	447.85	185.34	6.45	
5	478.84	135.08	4.33	
6	511.56	423.39	12.64	
7	542.59	94.49	2.61	
8	568.17	76.95	1.99	
9	594.57	111.17	2.7	
10	621.62	104.58	2.38	
11	645.2	65.12	1.4	
12	666.3	70.27	1.43	


SPECIMEN J41(250C)
SLOPE 111
INTERCEPT 201
J1C 236
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J41 (ALL DATA)


SPECIMEN J41
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                   TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J41
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                WELD(PN108)
 TEST TEMPERATURE(DEG C)                           250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         273
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       479.8
 CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
 SPECIMEN THICKNESS B(CM)                          2.544
 PERCENT SIDE GROOVE                               21.226
 SPECIMEN WIDTH W(CM)                              5.091
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.82776E+11
 EFFECTIVE MODULUS(Pa)                             1.93828326E+11

                   FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          26.09
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.194

                   CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.237
 INITIAL A/W                                       .627
 AVERAGE CRACK EXTENSION 9PT(CM)                   .508
 DELTA A(CM) COMPLIANCE                            .466
 MAX DEVIATION OF SINGLE MEASUREMENT %             4.3

                   ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    14
 LAST POINT                     20
 JIC(KN/M)                      236
 CORRELATION COEFF              .99
 SLOPE M(MPa)                   111
 INTERCEPT B (KN/M)             201

                   VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

                   QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          NO
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   377.15
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 269.33
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  1.897
 25*JQ/EF.Y.(CM)                                   1.567

                   CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       14
 LAST DATA POINT USED      29
 CONSTANT(C1)              319.13
 EXPONENT(C2)              .3886
```

J41(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
27.89	3.87	-.01	3.86	3.86	4.13	3.198	1
39.11	7.62	.18	7.79	7.79	8.33	3.204	2
49.19	12.05	1.73	13.78	13.77	14.67	3.194	3
58.46	17.02	5.21	22.22	22.22	23.48	3.196	4
65.95	21.65	12.89	34.55	34.53	36.17	3.193	5
70.85	24.99	26.7	51.69	51.68	53.57	3.192	6
73.68	27.03	46.36	73.39	73.35	75.42	3.191	7
75.91	28.69	67.58	96.27	96.34	98.4	3.194	8
78.26	30.5	90.33	120.82	121.26	123.01	3.202	9
79.67	31.6	114.6	146.2	146.91	148.43	3.207	10
81.41	33	139.51	172.5	173.94	174.75	3.216	11
82.49	33.88	165.8	199.68	201.83	201.91	3.224	12
84.04	35.17	190.73	225.9	230.53	228.01	3.245	13
84.35	35.42	219.72	255.14	259.98	257.25	3.247	14
85.27	36.2	245.8	282	289.56	284	3.265	15
86.7	37.43	269.62	307.04	319.21	308.87	3.292	16
87.84	38.42	295.25	333.66	349.12	335.39	3.309	17
88.38	38.89	321.69	360.58	380.19	362.14	3.329	18
89.26	39.67	344.78	384.45	411.31	385.78	3.36	19
89.81	40.16	369.47	409.63	442.69	410.75	3.385	20
89.73	40.08	394.7	434.78	474.62	435.65	3.41	21
90.7	40.96	412.56	453.52	505.86	454.14	3.453	22
91.11	41.33	436.5	477.83	537.34	478.26	3.475	23
90.79	41.03	457.19	498.22	568.95	498.36	3.509	24
92.13	42.26	473.47	515.73	599.22	515.72	3.545	25
91.27	41.47	494.23	535.7	630.95	535.37	3.576	26
90.69	40.95	514.92	555.87	661.9	555.29	3.603	27
91.05	41.27	530.44	571.71	692.15	570.94	3.637	28
90.83	41.07	549.24	590.31	721	589.36	3.66	29

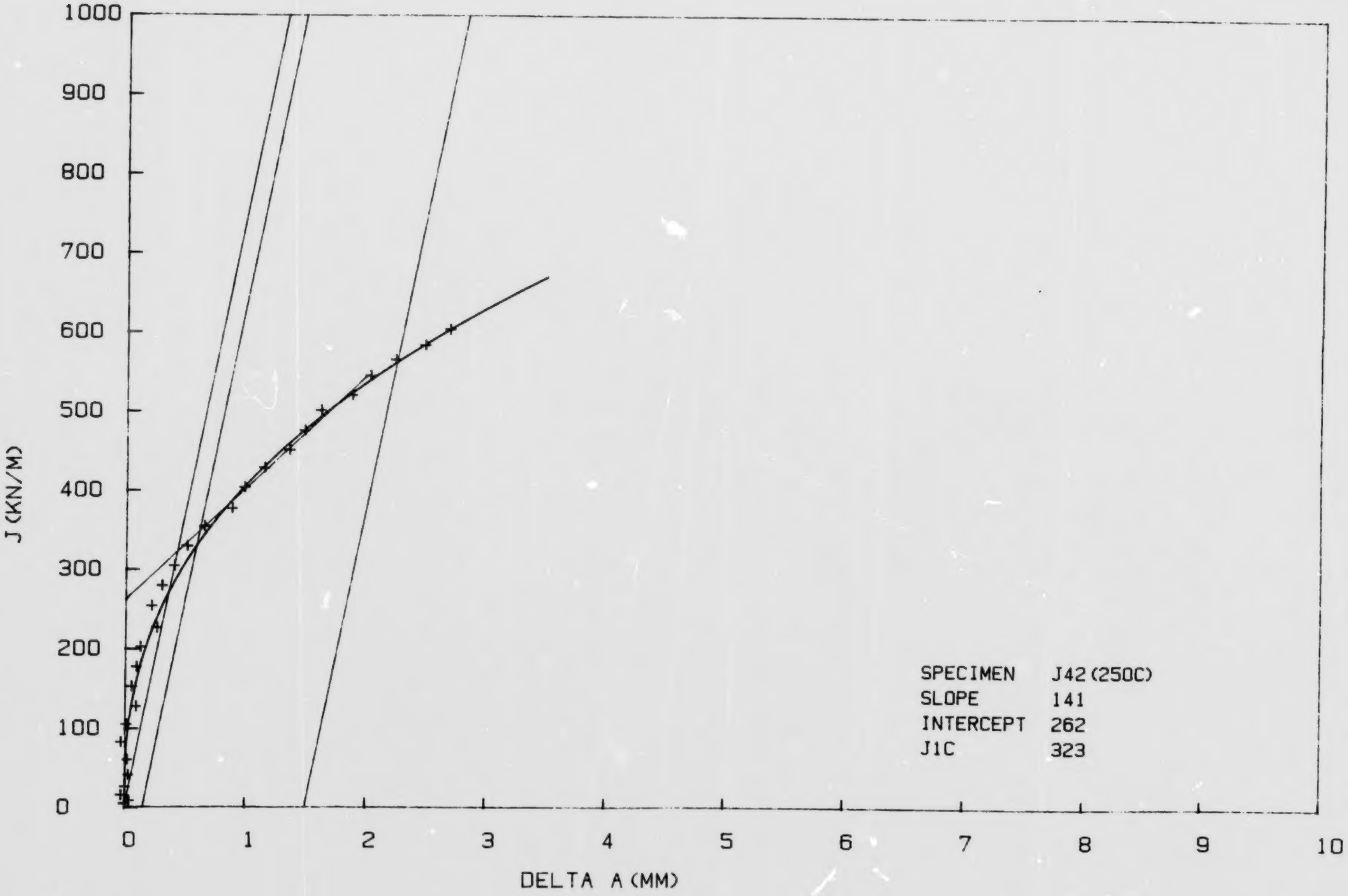
H(M)	D(M)	POISSON'S RATIO
.01906	2.54E-03	.3

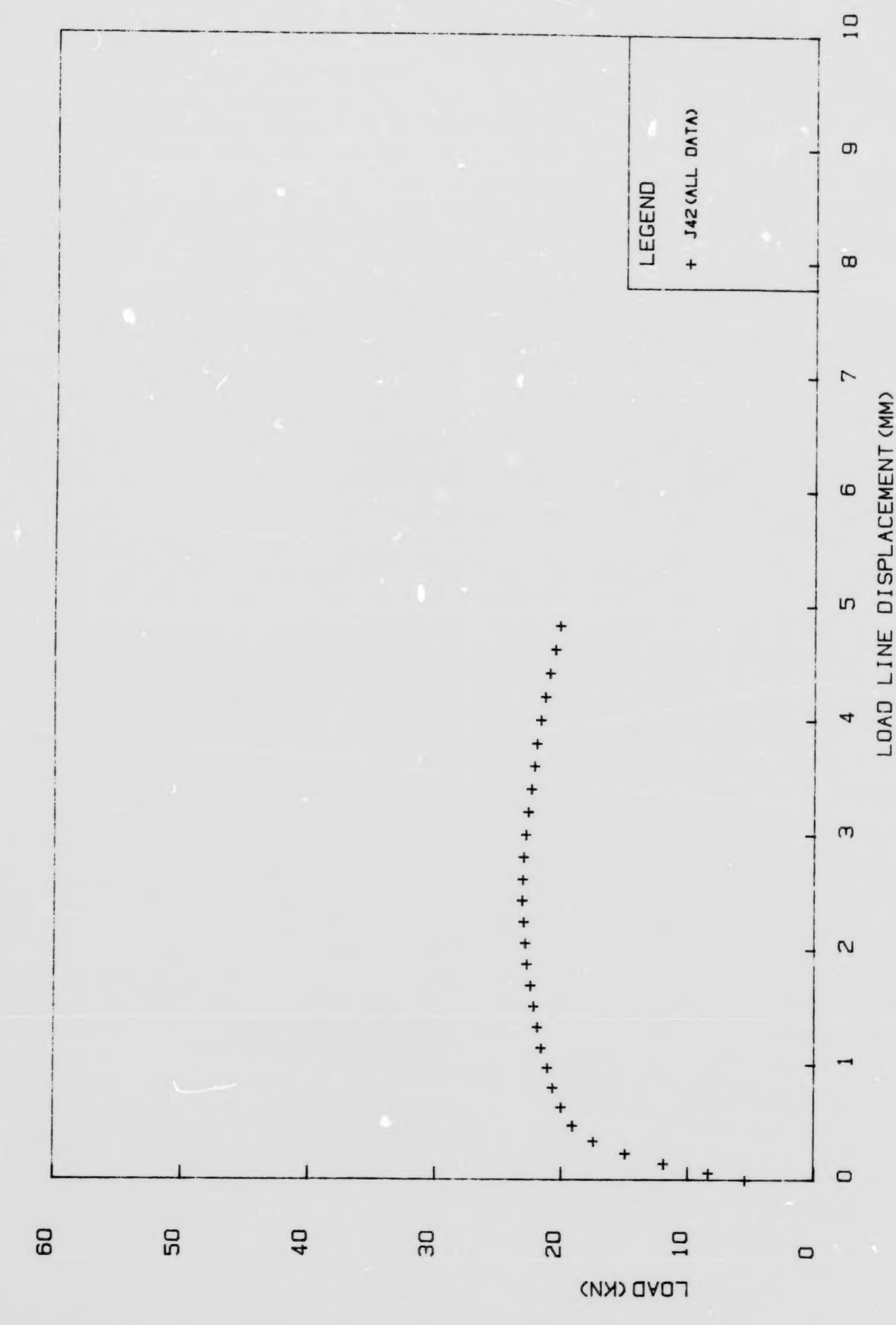
J41

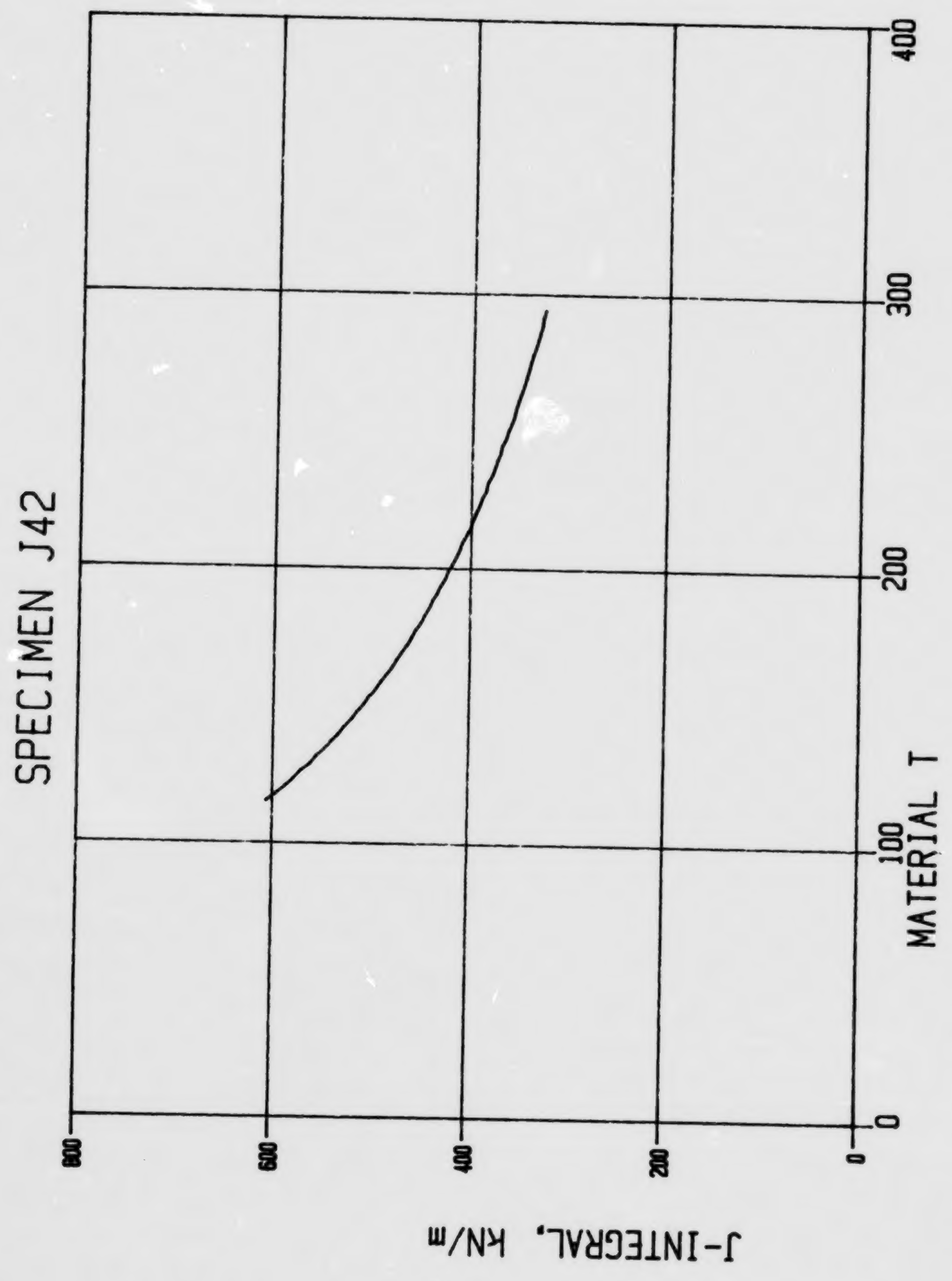
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
3.86	3.197	3.198	.038	.9995	1
7.79	3.204	3.204	.103	.9997	2
13.78	3.193	3.194	-2E-03	.9999	3
22.22	3.195	3.196	.025	.9998	4
34.55	3.191	3.193	-.014	.9999	5
51.69	3.189	3.192	-.019	1	6
73.39	3.187	3.191	-.034	.9998	7
96.27	3.19	3.194	1E-03	.9998	8
120.82	3.197	3.202	.082	1	9
146.2	3.201	3.207	.128	1	10
172.5	3.209	3.216	.22	.9999	11
199.68	3.215	3.224	.295	.9999	12
225.9	3.236	3.245	.514	.9999	13
255.14	3.237	3.247	.53	.9998	14
282	3.254	3.265	.708	.9998	15
307.04	3.28	3.292	.977	.9998	16
333.66	3.296	3.309	1.151	.9998	17
360.58	3.315	3.329	1.348	.9999	18
384.45	3.346	3.36	1.663	1	19
409.63	3.37	3.385	1.91	.9999	20
434.78	3.394	3.41	2.16	.9999	21
453.52	3.436	3.453	2.585	.9999	22
477.83	3.458	3.475	2.814	.9999	23
498.22	3.491	3.509	3.149	.9999	24
515.73	3.526	3.545	3.506	.9999	25
535.7	3.557	3.576	3.818	.9997	26
555.87	3.583	3.603	4.087	.9998	27
571.71	3.617	3.637	4.428	.9998	28
590.31	3.639	3.66	4.659	.9999	29

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J41
1	6.042	0	
2	9.277	.054	
3	12.939	.12	
4	16.418	.193	
5	19.47	.278	
6	22.034	.383	
7	23.682	.515	
8	24.658	.671	
9	25.33	.833	
10	25.94	1.003	
11	26.306	1.174	
12	26.672	1.353	
13	26.855	1.533	
14	26.855	1.721	
15	26.917	1.907	
16	26.794	2.097	
17	26.611	2.29	
18	26.55	2.48	
19	26.245	2.678	
20	25.757	2.881	
21	25.33	3.083	
22	24.719	3.291	
23	23.987	3.503	
24	23.56	3.711	
25	22.705	3.926	
26	22.217	4.136	
27	21.301	4.355	
28	20.569	4.573	
29	19.897	4.792	
30	19.348	5	

	J(KN/M)	T	W	J41
1	240.52	2377.52	141.29	
2	268.57	194	10.23	
3	294.52	120.05	5.68	
4	320.35	198.24	8.55	
5	347.12	175.72	6.91	
6	372.52	97.86	3.52	
7	397.04	131.37	4.38	
8	422.21	130.13	4.02	
9	444.15	56.76	1.62	
10	465.67	136.99	3.68	
11	488.03	78.71	1.98	
12	506.98	63.26	1.5	
13	525.71	82.44	1.84	
14	545.78	96.65	2.04	
15	563.79	59.96	1.2	
16	581.01	103.98	1.99	


1000
900
800
700
600
500
400
300
200
100
0
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J42 (250C)
SLOPE 141
INTERCEPT 262
J1C 323


LEGEND
+ J42 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10



SPECIMEN J42
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J42
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN108)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	273
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	479.8
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	21.22
SPECIMEN WIDTH W(CM)	5.093
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.00057753E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	30.25
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.364

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.4227
INITIAL A/W	.661
AVERAGE CRACK EXTENSION 9PT(CM)	.312
DELTA A(CM) COMPLIANCE	.269
MAX DEVIATION OF SINGLE MEASUREMENT %	.8774

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	18
LAST POINT	26
JIC(KN/M)	323
CORRELATION COEFF	.99
SLOPE M(MPa)	141
INTERCEPT B (KN/M)	262

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	NO
LIGAMENT>25JIC/EFFECTIVE YIELD	NO
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	376.59
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	274.8
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.729
25*JQ/EF.Y.(CM)	2.145

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	18
LAST DATA POINT USED	29
CONSTANT(C1)	408.32
EXPONENT(C2)	.3968

J42(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
29.08	4.21	.01	4.23	4.23	4.56	3.364	1
41.54	8.59	.26	8.85	8.85	9.51	3.368	2
51.87	13.39	2.58	15.97	15.97	17.04	3.361	3
60.72	18.36	8.11	26.47	26.48	27.91	3.364	4
66.63	22.1	19.45	41.56	41.58	43.27	3.367	5
69.77	24.24	36.75	60.99	61	62.87	3.366	6
71.76	25.64	57.43	83.07	82.94	85.12	3.361	7
73.55	26.93	78.49	105.43	105.48	107.53	3.366	8
75.78	28.59	99.37	127.97	128.46	130.12	3.373	9
76.6	29.21	123.93	153.15	153.38	155.39	3.37	10
77.96	30.26	147.48	177.74	178.34	180.02	3.374	11
79.05	31.11	171.63	202.74	203.69	205.05	3.377	12
81.13	32.77	194.32	227.09	229.71	229.38	3.39	13
81.22	32.84	221.72	254.56	256.54	256.92	3.386	14
82.32	33.74	246.12	279.86	283.27	282.19	3.395	15
83.54	34.75	270.25	305	310.22	307.29	3.405	16
84.15	35.25	294.8	330.05	337.37	332.27	3.415	17
85.08	36.04	318.99	355.03	365.5	357.15	3.429	18
86.28	37.06	340.72	377.78	393.69	379.75	3.452	19
86.47	37.23	367.43	404.66	423.31	406.51	3.463	20
86.91	37.61	391.78	429.39	452.56	431.09	3.479	21
87.77	38.35	413.7	452.05	481.51	453.59	3.5	22
88.15	38.68	438.03	476.71	510.19	478.14	3.512	23
88.11	38.66	463.45	502.11	540.19	503.38	3.526	24
88.98	39.42	481.89	521.31	568.91	522.41	3.552	25
88.81	39.27	506.38	545.64	598.92	546.57	3.566	26
88.97	39.41	526.88	566.3	628.25	567.04	3.588	27
89.7	40.06	544.71	584.77	657.18	585.35	3.612	28
89.8	40.15	564.32	604.47	686.18	604.87	3.633	29

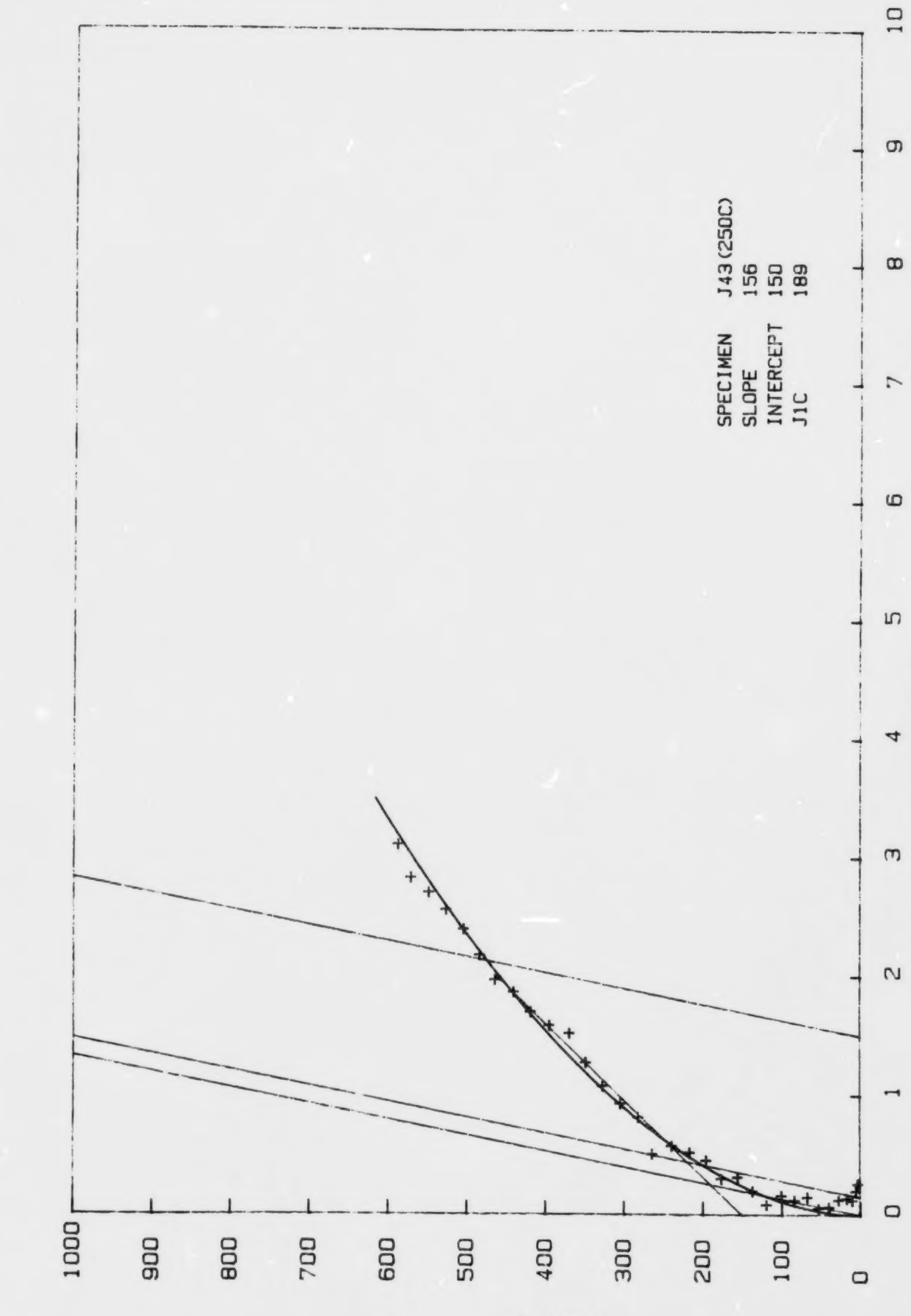
H(M)	D(M)	POISSON´S RATIO
.01903	2.54E-03	.3

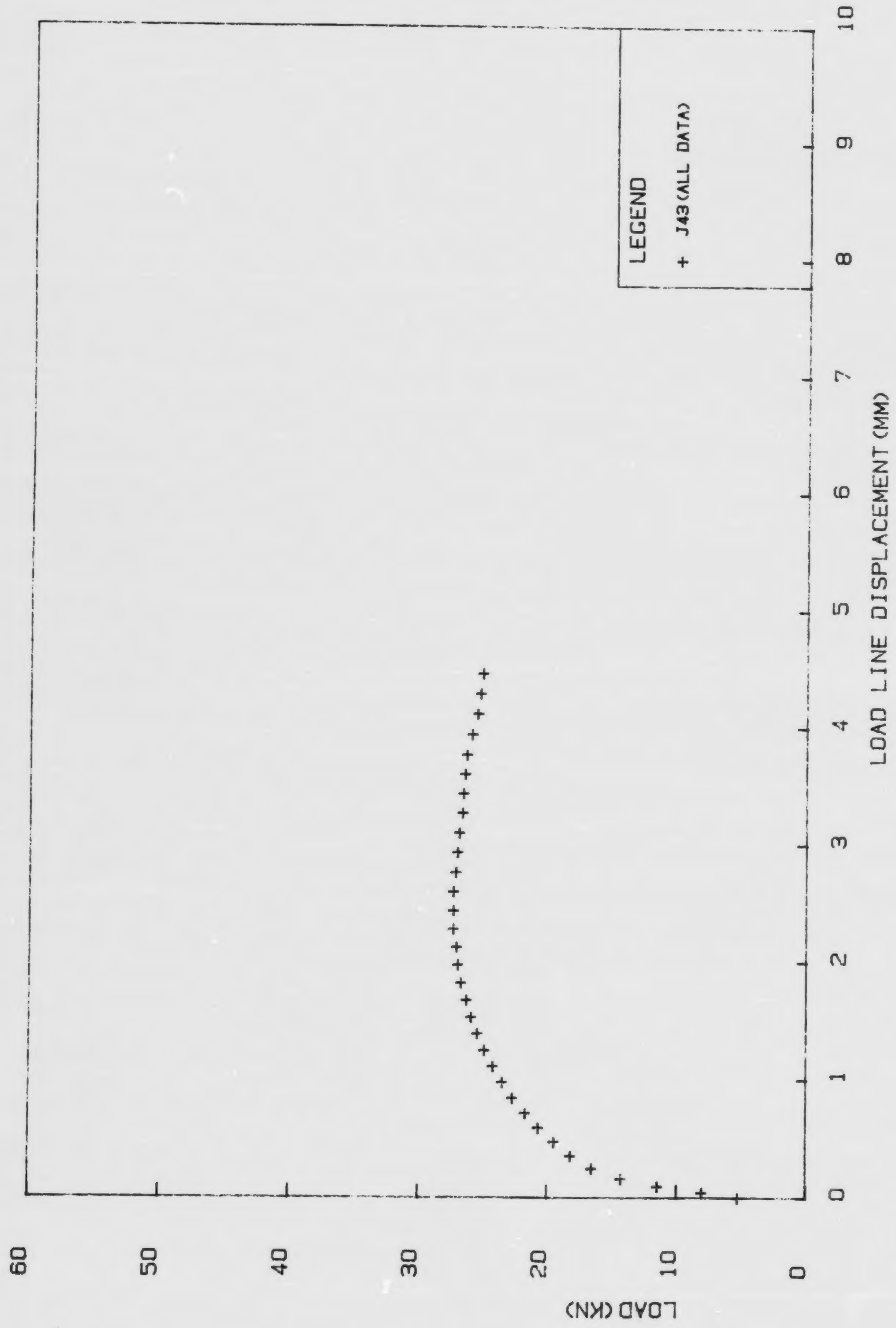
J42

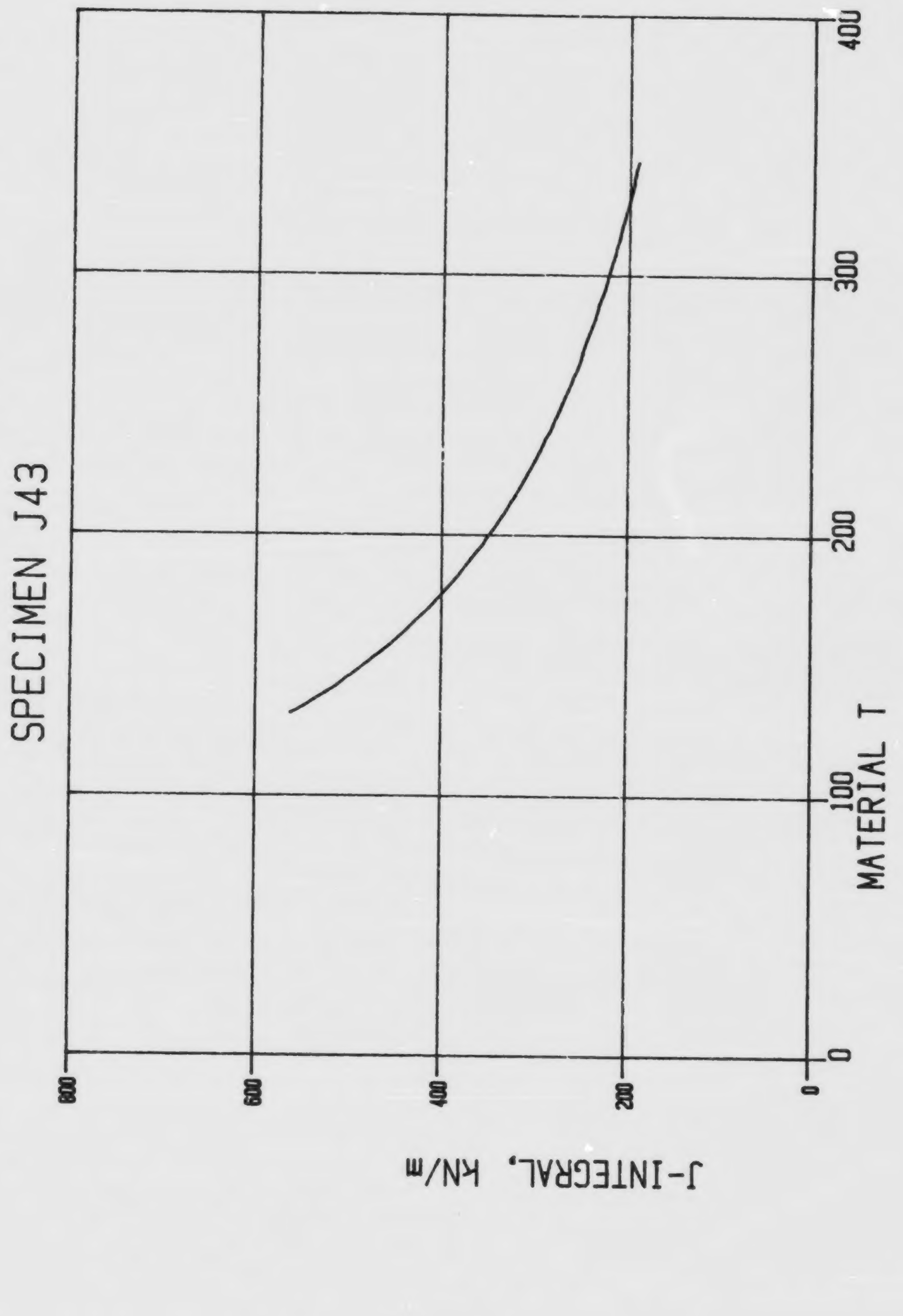
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
4.23	3.364	3.364	1E-03	.9996	1
8.85	3.367	3.368	.038	.9999	2
15.97	3.36	3.361	-.029	.9999	3
26.47	3.363	3.364	3E-03	.9999	4
41.56	3.365	3.367	.031	.9998	5
60.99	3.363	3.366	.023	1	6
83.07	3.357	3.361	-.029	.9998	7
105.43	3.361	3.366	.016	.9999	8
127.97	3.368	3.373	.092	.9999	9
153.15	3.363	3.37	.056	.9999	10
177.74	3.367	3.374	.097	.9999	11
202.74	3.369	3.377	.13	.9999	12
227.09	3.381	3.39	.263	.9999	13
254.56	3.376	3.386	.217	.9998	14
279.86	3.384	3.395	.305	.9999	15
305	3.393	3.405	.405	.9998	16
330.05	3.403	3.415	.51	.9999	17
355.03	3.416	3.429	.653	.9999	18
377.78	3.438	3.452	.881	.9998	19
404.66	3.448	3.463	.986	.9998	20
429.39	3.463	3.479	1.148	.9997	21
452.05	3.483	3.5	1.357	.9999	22
476.71	3.495	3.512	1.482	.9998	23
502.11	3.508	3.526	1.616	.9999	24
521.31	3.533	3.552	1.877	.9999	25
545.64	3.547	3.566	2.024	.9999	26
566.3	3.568	3.588	2.238	.9998	27
584.77	3.592	3.612	2.482	.9998	28
604.47	3.612	3.633	2.689	.9998	29

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J42
1	5.432	0	
2	8.362	.061	
3	11.902	.139	
4	14.954	.227	
5	17.456	.334	
6	19.104	.469	
7	20.02	.627	
8	20.691	.798	
9	21.118	.972	
10	21.606	1.145	
11	21.912	1.326	
12	22.217	1.506	
13	22.461	1.687	
14	22.766	1.873	
15	22.888	2.056	
16	23.01	2.241	
17	23.132	2.427	
18	23.071	2.612	
19	23.01	2.805	
20	22.827	3	
21	22.644	3.201	
22	22.4	3.401	
23	22.156	3.601	
24	21.973	3.796	
25	21.667	4.001	
26	21.301	4.204	
27	20.935	4.412	
28	20.508	4.619	
29	20.142	4.827	
30	19.714	5.034	

	J(KN/M)	T	W	J42
1	317.52	310	12.7	
2	342.54	224.22	8.44	
3	366.4	129.09	4.48	
4	391.22	327.63	10.58	
5	417.03	197.71	5.93	
6	440.72	140.01	3.92	
7	464.38	254.26	6.71	
8	489.41	243.94	6.06	
9	511.71	94.9	2.22	
10	533.48	212.91	4.72	
11	555.97	124.99	2.62	
12	575.53	97.72	1.95	
13	594.62	122.64	2.33	


SPECIMEN J43 (250C)
SLOPE 156
INTERCEPT 150
J1C 189
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J43 (ALL DATA)


SPECIMEN J43
J-INTEGRAL, kN/m
MATERIAL T
0
200
400
600
800
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

   SPECIMEN NUMBER                                      J43
   MATERIAL TYPE                                        A106B
   MATERIAL CONDITION                                   HAZ(PN108)
   TEST TEMPERATURE(DEG C)                              250
   MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            273
   MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          479.8
   CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
   SPECIMEN THICKNESS B(CM)                             2.54
   PERCENT SIDE GROOVE                                  21.181
   SPECIMEN WIDTH W(CM)                                 5.083
   YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
   EFFECTIVE MODULUS(Pa)                                2.01997679E+11

                FATIGUE PRE-CRACKING DATA

   MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
   MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             24.67
   INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.117

                CRACK LENGTH MEASUREMENT

   AVERAGE FATIGUE LENGTH 9PT(CM)                       3.217
   INITIAL A/W                                          .613
   AVERAGE CRACK EXTENSION 9PT(CM)                      .355
   DELTA A(CM) COMPLIANCE                               .311
   MAX DEVIATION OF SINGLE MEASUREMENT %                1.13

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

   FIRST POINT                      15
   LAST POINT                       27
   JIC(KN/M)                        189
   CORRELATION COEFF                .97
   SLOPE M(MPa)                     156
   INTERCEPT B (KN/M)               150

                VALIDITY(JIC)

   BN>25JIC/EFFECTIVE YIELD         YES
   LIGAMENT>25JIC/EFFECTIVE YIELD YES
   DJ/DA<EFFECTIVE YIELD            YES

                QUALIFICATION OF R-CURVE DATA

   CRACK EXTENSION VALIDITY                             YES
   CRACK SIZE DA<0.15*DELTA A                           YES
   J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      376.78
   OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    311.5
   DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.966
   25*JQ/EF.Y.(CM)                                      1.255

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

   1st DATA POINT USED         15
   LAST DATA POINT USED        33
   CONSTANT(C1)                318.03
   EXPONENT(C2)                .5294
```

```
                J43(250C)

  K          J-ELASTIC     J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)   CR.  LN
  (MPaRTM)   (KN/M)        (KN/M)        (KN/M)      (KN/M)         (KN/M)          (CM)

  23.3       2.7           .02           2.72         2.72         2.83        3.143   1
  33.02      5.43          .08           5.51         5.51         5.83        3.137   2
  40.84      8.31          1.74          10.05        10.05        10.59       3.129   3
  47.36      11.17         6.07          17.24        17.24        17.98       3.131   4
  52.03      13.48         14.12         27.59        27.59        28.5        3.13    5
  55.42      15.29         24.72         40.02        39.96        41.08       3.124   6
  58.84      17.24         36.16         53.39        53.32        54.61       3.123   7
  62.27      19.3          48.51         67.81        67.96        69.13       3.132   8
  64.93      20.99         63.03         84.02        84.09        85.47       3.129   9
  67.41      22.62         78.18         100.8        101.03       102.35      3.133   10
  69.09      23.76         95.74         119.5        119.34       121.17      3.126   11
  71.66      25.57         111.69        137.25       137.81       138.99      3.137   12
  73.92      27.2          128.94        156.14       157.54       157.92      3.148   13
  75.25      28.19         148.33        176.52       177.8        178.38      3.147   14
  77.29      29.74         166.23        195.97       198.78       197.84      3.163   15
  78.98      31.05         185.9         216.95       220.51       218.88      3.169   16
  80.06      31.91         207.63        239.54       243.77       241.49      3.175   17
  79.96      31.83         232.62        264.45       267.71       266.45      3.168   18
  82.79      34.12         248.09        282.21       290.32       284.19      3.199   19
  83.57      34.77         270.16        304.93       314.93       306.87      3.21    20
  84.64      35.67         291.65        327.32       340.1        329.22      3.225   21
  85.49      36.39         312.69        349.08       365.78       350.89      3.245   22
  86.94      37.63         332.25        369.88       391.9        371.61      3.269   23
  87.07      37.74         357.44        395.18       418.79       396.86      3.276   24
  87.13      37.8          381.61        419.41       445.83       420.99      3.287   25
  88.23      38.76         402.26        441.02       471.96       442.55      3.304   26
  88.63      39.11         425.57        464.69       498.55       466.16      3.314   27
  89.89      40.23         443.86        484.09       524.24       485.52      3.335   28
  90.21      40.52         463.85        504.37       551.5        505.66      3.357   29
  90.08      40.4          486.42        526.83       579.49       527.98      3.373   30
  90.65      40.91         507.73        548.64       606.44       549.72      3.387   31
  91.05      41.28         530.13        571.4        633.89       572.41      3.4     32
  91.48      41.66         546.33        587.99       661.51       588.86      3.428   33

  H(M)            D(M)            POISSON'S RATIO
  .01902          2.54E-03        .3
```

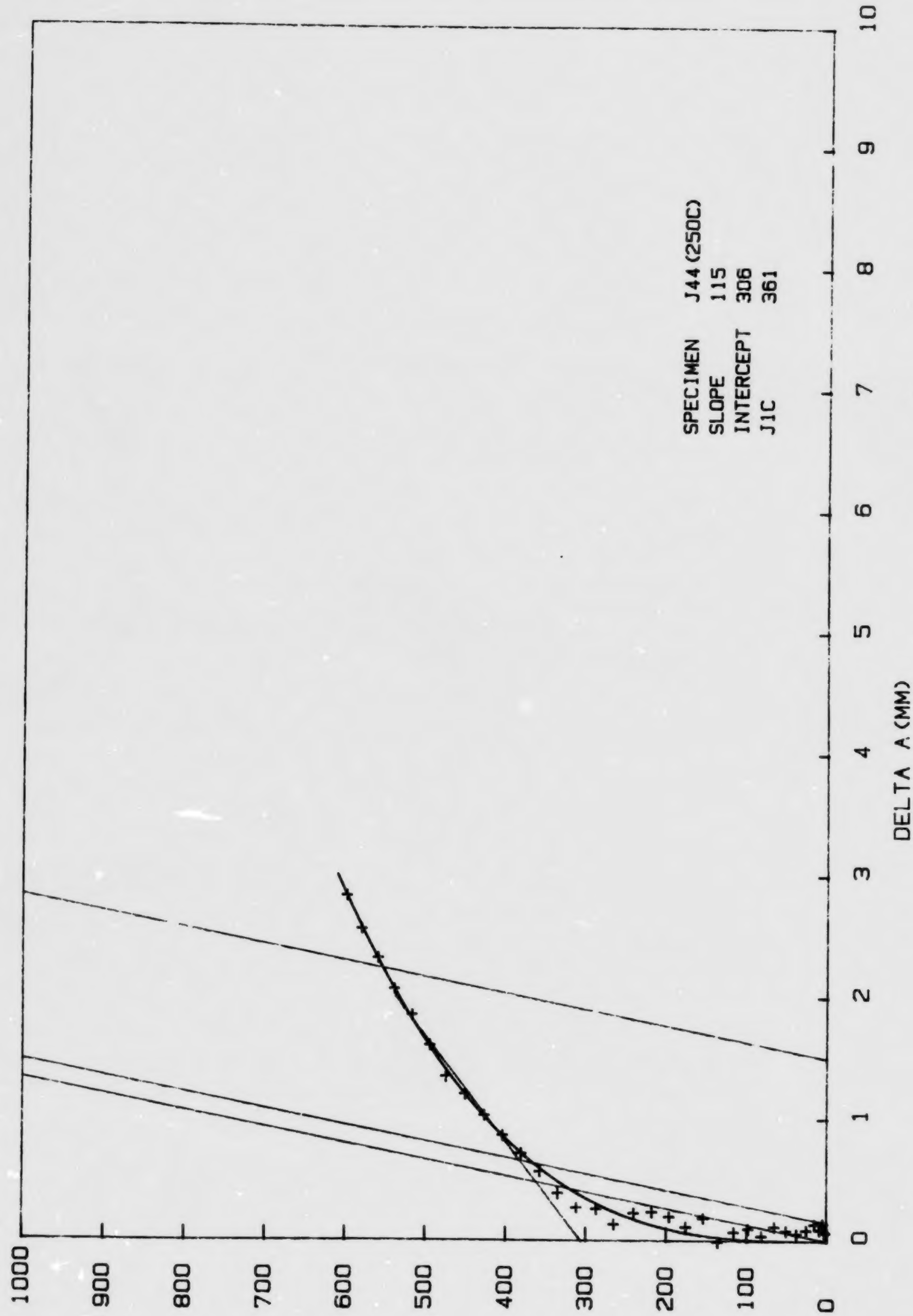
J43

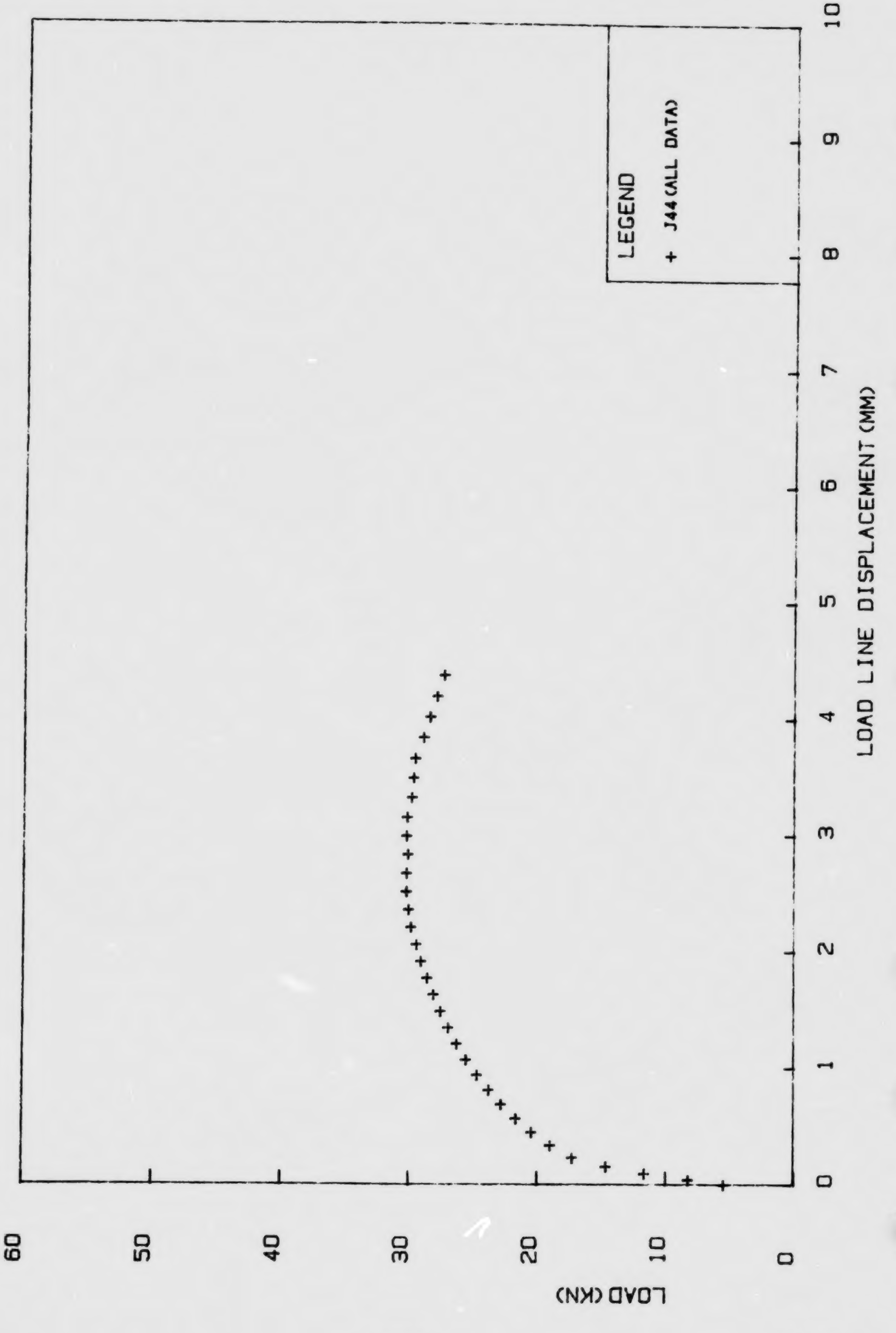
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.72	3.143	3.143	.262	.9999	1
5.51	3.137	3.137	.201	.9999	2
10.05	3.129	3.129	.125	1	3
17.24	3.13	3.131	.139	.9997	4
27.59	3.128	3.13	.128	1	5
40.02	3.121	3.124	.067	1	6
53.39	3.119	3.123	.055	.9995	7
67.81	3.128	3.132	.151	1	8
84.02	3.125	3.129	.125	.9999	9
100.8	3.128	3.133	.163	.9999	10
119.5	3.12	3.126	.088	1	11
137.25	3.13	3.137	.202	.9998	12
156.14	3.141	3.148	.315	1	13
176.52	3.139	3.147	.301	.9995	14
195.97	3.153	3.163	.457	.9994	15
216.95	3.159	3.169	.523	.9993	16
239.54	3.164	3.175	.578	.9999	17
264.45	3.156	3.168	.508	.9995	18
282.21	3.186	3.199	.819	.9998	19
304.93	3.197	3.21	.931	.9999	20
327.32	3.211	3.225	1.081	.9999	21
349.08	3.23	3.245	1.276	1	22
369.88	3.254	3.269	1.522	.999	23
395.18	3.26	3.276	1.59	.9998	24
419.41	3.27	3.287	1.702	.9997	25
441.02	3.286	3.304	1.87	.9999	26
464.69	3.295	3.314	1.971	.9998	27
484.09	3.315	3.335	2.178	.9999	28
504.37	3.337	3.357	2.396	.9998	29
526.83	3.352	3.373	2.56	.9998	30
548.64	3.366	3.387	2.704	.9999	31
571.4	3.378	3.4	2.828	.9999	32
587.99	3.405	3.428	3.108	.9998	33

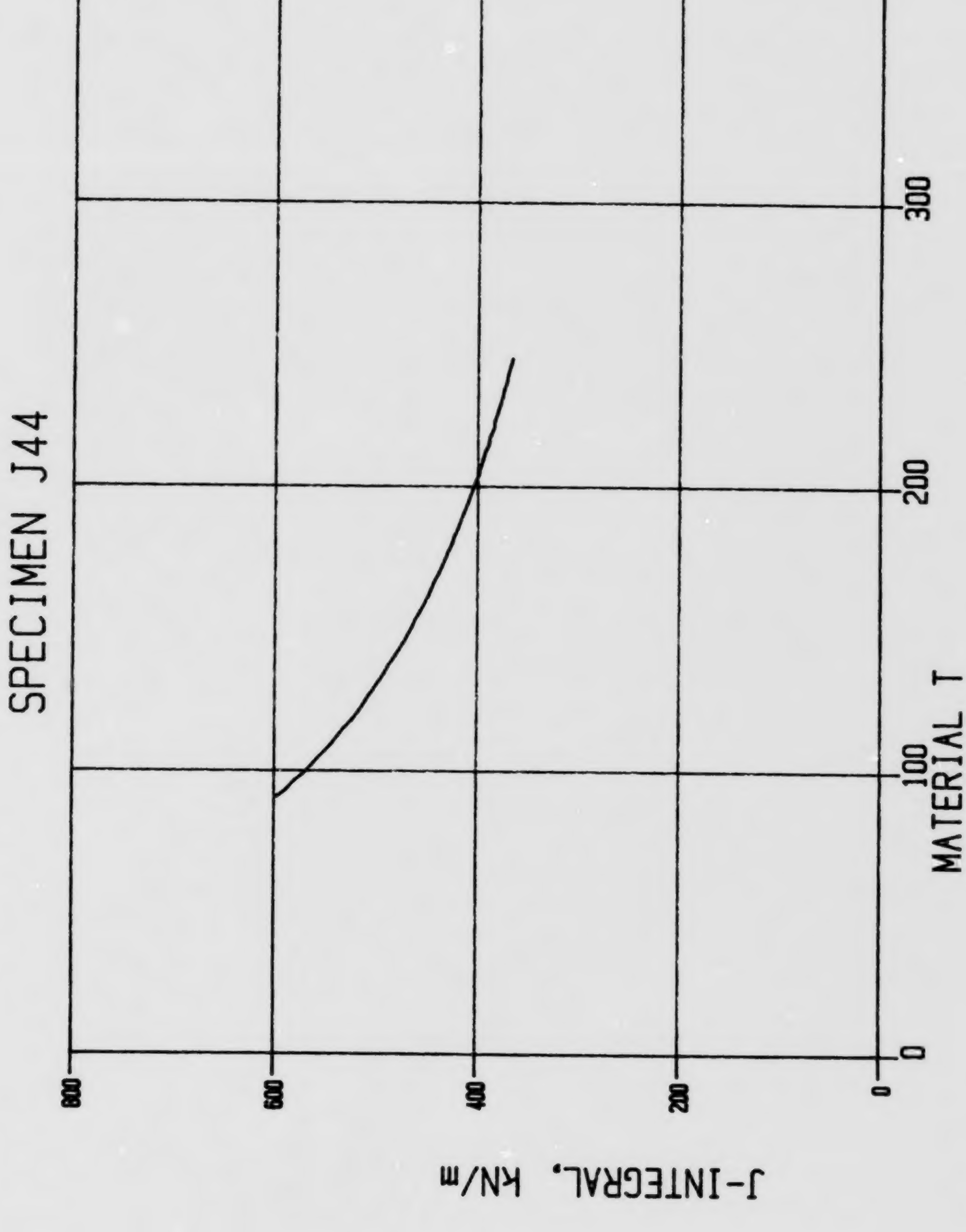
```
          LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J43
 1         5.249         0
 2         8.057          .045
 3        11.475          .099
 4        14.282          .164
 5        16.541          .249
 6        18.188          .356
 7        19.47           .474
 8        20.691          .593
 9        21.729          .719
 10       22.705          .848
 11       23.499          .98
 12       24.231         1.116
 13       24.902         1.252
 14       25.452         1.394
 15       25.94          1.533
 16       26.306         1.678
 17       26.733         1.824
 18       26.978         1.976
 19       27.1           2.129
 20       27.344         2.281
 21       27.344         2.439
 22       27.344         2.6
 23       27.161         2.765
 24       27.039         2.933
 25       26.917         3.101
 26       26.672         3.27
 27       26.611         3.436
 28       26.489         3.602
 29       26.367         3.766
 30       25.94          3.939
 31       25.513         4.116
 32       25.33          4.287
 33       25.146         4.46
 34       24.597         4.641
```

```
        J(KN/M)                  T               W      J43

  1          186.25      161.28            12.89
  2          206.46      407.33            29.27
  3          228.25      535.06            34.67
  4          251.99      -461.11           -27.16
  5          273.33      73.78             3.94
  6          293.57      261.74            12.94
  7          316.12      192.19            8.76
  8          338.2       143.69            6.05
  9          359.48      109.32            4.28
  10         382.53      477.57            17.49
  11         407.3       279.94            9.57
  12         430.22      165.97            5.32
  13         452.85      299.84            9.08
  14         474.39      121.14            3.46
  15         494.23      119.86            3.25
  16         515.6       177.19            4.56
  17         537.73      195.56            4.78
  18         560.02      235.54            5.49
  19         579.7       76.43             1.69
```


SPECIMEN J44 (250C)
SLOPE 115
INTERCEPT 306
J1C 361
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J44 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J44
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                  J44
 MATERIAL TYPE                                    A106B
 MATERIAL CONDITION                               HAZ(PN108)
 TEST TEMPERATURE(DEG C)                          250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        273
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      479.8
 CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
 SPECIMEN THICKNESS B(CM)                         2.539
 PERCENT SIDE GROOVE                              20.322
 SPECIMEN WIDTH W(CM)                             5.082
 YOUNGS MODULUS AT TEST TEMP(Pa)                  1.82776E+11
 EFFECTIVE MODULUS(Pa)                            2.01661674E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN            10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         23.88
 INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.074

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                   3.156
 INITIAL A/W                                      .605
 AVERAGE CRACK EXTENSION 9PT(CM)                  .333
 DELTA A(CM) COMPLIANCE                           .283
 MAX DEVIATION OF SINGLE MEASUREMENT %            .69

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     23
 LAST POINT                      30
 JIC(KN/M)                       361
 CORRELATION COEFF               .98
 SLOPE M(MPa)                    115
 INTERCEPT B (KN/M)              306

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        NO
 LIGAMENT>25JIC/EFFECTIVE YIELD  NO
 DJ/DA<EFFECTIVE YIELD           YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                         NO
 CRACK SIZE DA<0.15*DELTA A                       NO
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  380.73
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                324.65
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 2.008
 25*JQ/EF.Y.(CM)                                  2.398

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        23
 LAST DATA POINT USED       33
 CONSTANT(C1)               424.15
 EXPONENT(C2)               .3301
```

J44(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.58	2.54	.04	2.58	2.58	2.72	3.081	1
32.13	5.14	.1	5.23	5.23	5.54	3.089	2
40.21	8.05	1.32	9.37	9.37	9.87	3.084	3
47.58	11.27	4.33	15.6	15.6	16.31	3.088	4
52.09	13.51	12.42	25.92	25.91	26.8	3.083	5
55.98	15.6	22.46	38.06	38.02	39.08	3.08	6
59.44	17.59	33.7	51.29	51.29	52.43	3.083	7
62.78	19.63	46.21	65.83	65.91	67.09	3.086	8
65.08	21.09	60.72	81.81	81.66	83.2	3.078	9
67.89	22.95	75.32	98.26	98.34	99.75	3.084	10
70.09	24.46	91.81	116.27	116.22	117.87	3.082	11
71.64	25.55	110.49	136.04	135.5	137.76	3.073	12
74.61	27.71	126.42	154.13	154.99	155.88	3.093	13
75.85	28.65	147.02	175.67	175.92	177.53	3.086	14
77.89	30.21	166.02	196.23	197.31	198.14	3.094	15
79.48	31.45	186.39	217.84	219.34	219.81	3.098	16
80.77	32.48	207.9	240.38	241.75	242.43	3.097	17
81.19	32.82	232.43	265.26	265.36	267.39	3.088	18
83.2	34.46	252.52	286.99	289.02	289.14	3.101	19
83.78	34.94	276.57	311.51	313.71	313.69	3.102	20
85.07	36.03	298.65	334.68	338.97	336.85	3.113	21
86.29	37.07	319.97	357.04	364.83	359.17	3.131	22
87	37.69	342.91	380.59	391.58	382.65	3.146	23
88.39	38.9	364.7	403.6	417.87	405.63	3.16	24
89.43	39.82	386.53	426.35	444.7	428.34	3.177	25
89.61	39.98	410.66	450.65	473.45	452.51	3.194	26
90.34	40.63	433.97	474.6	501.44	476.41	3.209	27
91.96	42.11	452.33	494.44	528.93	496.19	3.234	28
91.83	41.98	474.57	516.55	558.81	518.11	3.259	29
91.96	42.1	496.63	538.74	587.99	540.16	3.28	30
92.23	42.35	516.67	559.02	617.12	560.29	3.306	31
92.39	42.5	537.03	579.53	646.51	580.65	3.33	32
92.81	42.89	555.11	598	675.48	598.98	3.357	33

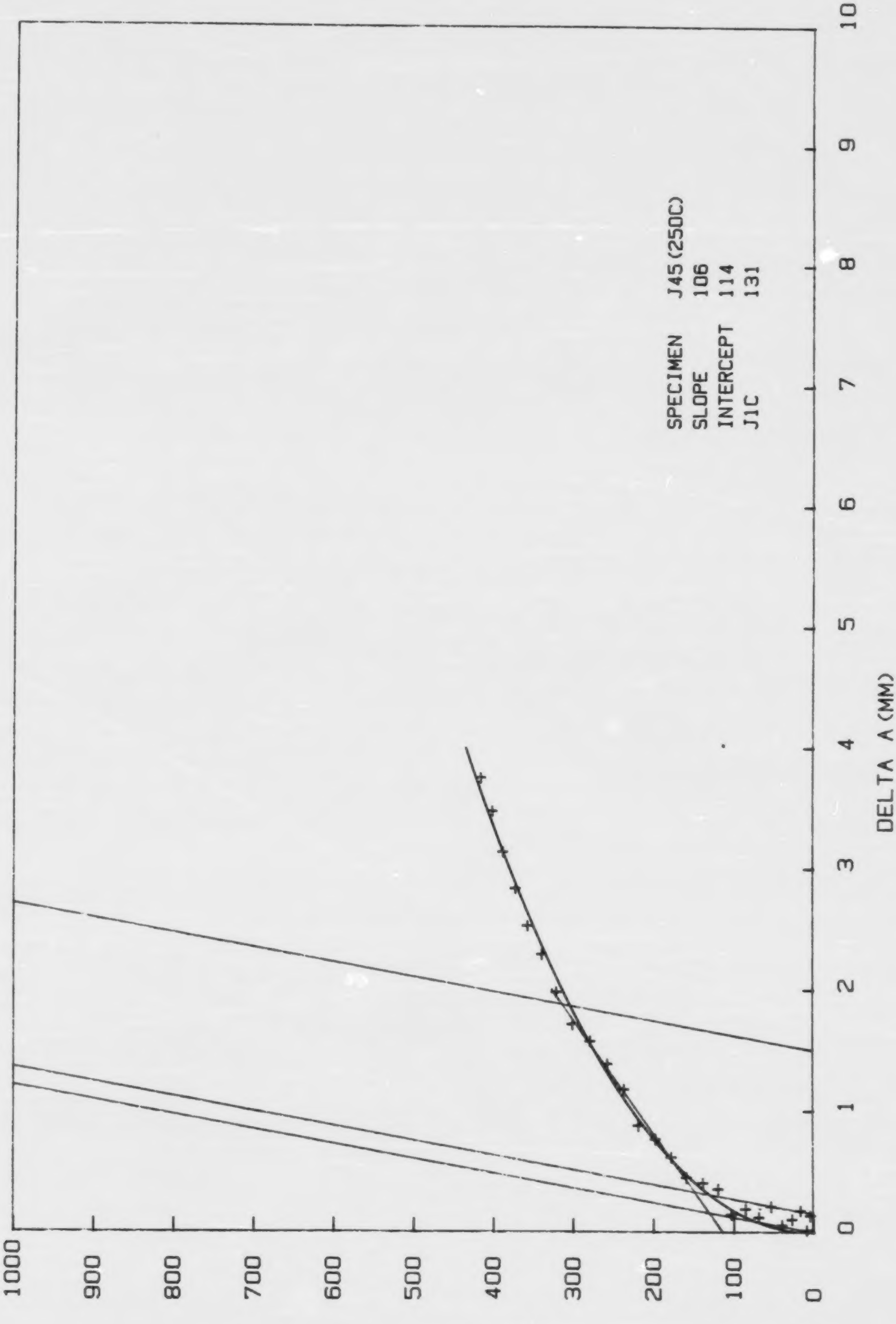
H(M)	D(M)	POISSON´S RATIO
.01905	2.54E-03	.3

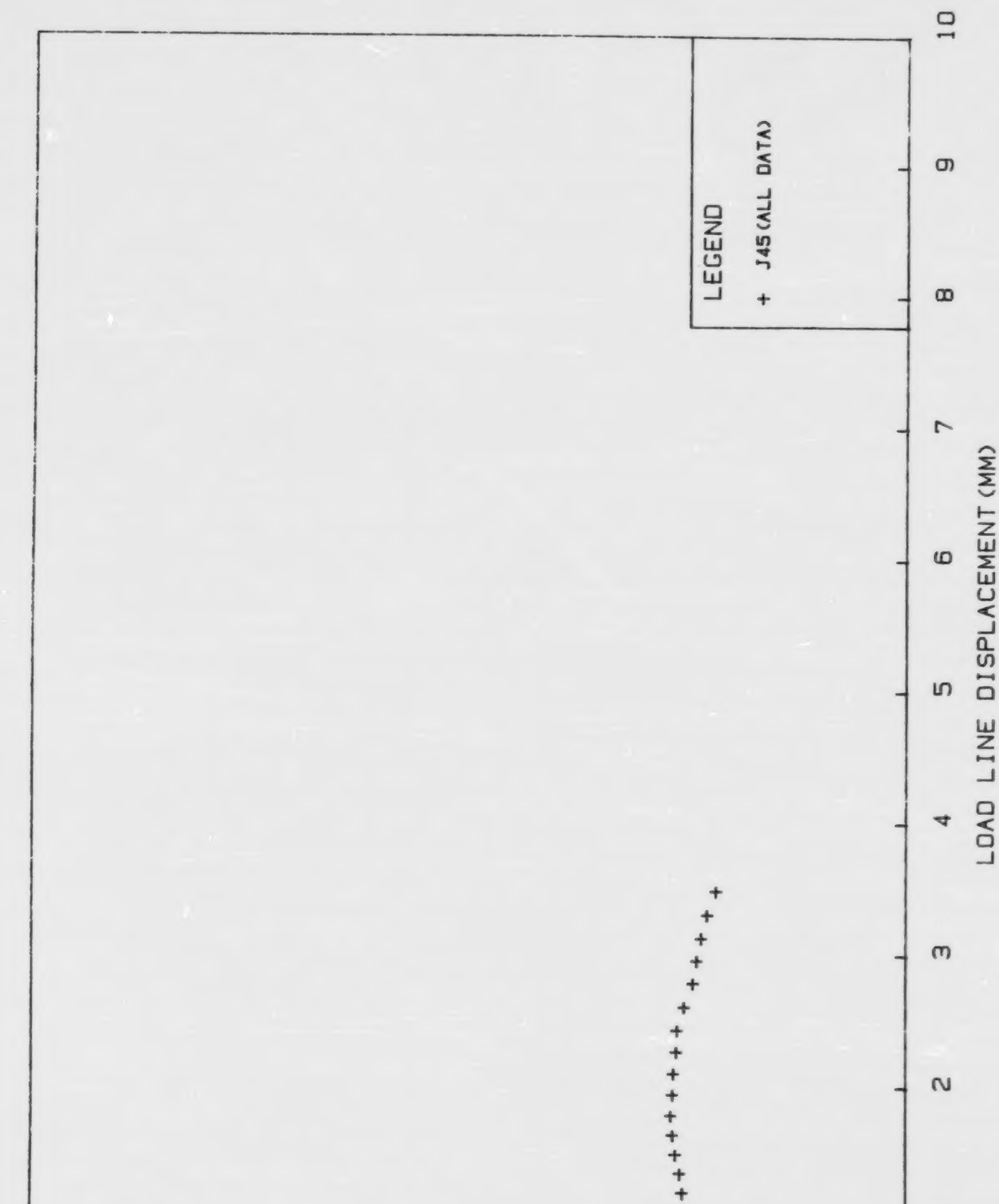
J44

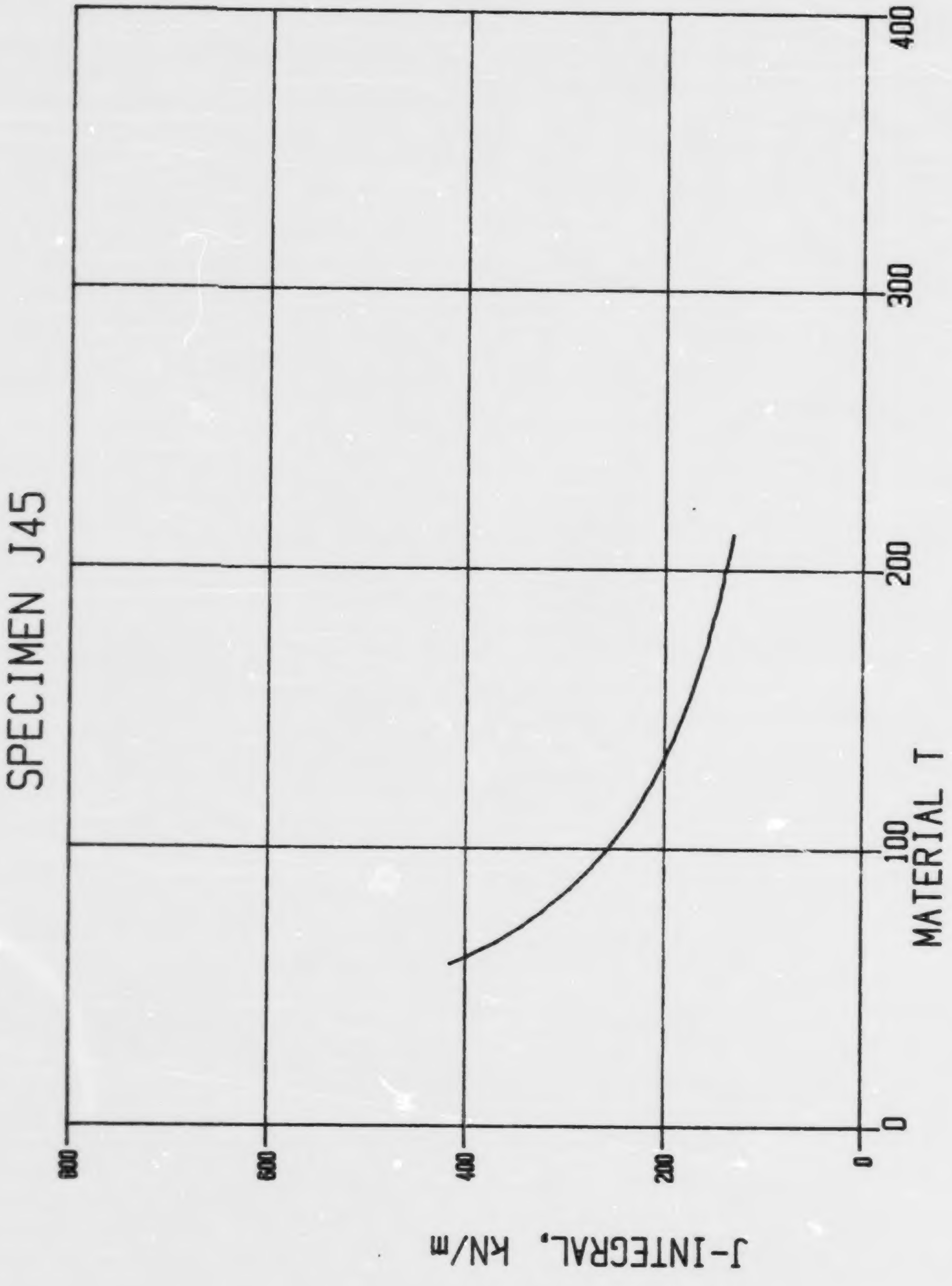
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.58	3.081	3.081	.074	.9997	1
5.23	3.088	3.089	.146	.9999	2
9.37	3.083	3.084	.097	.9999	3
15.6	3.087	3.088	.141	.9999	4
25.92	3.081	3.083	.092	.9999	5
38.06	3.078	3.08	.061	.9999	6
51.29	3.08	3.083	.087	.9999	7
65.83	3.082	3.086	.121	1	8
81.81	3.074	3.078	.045	.9999	9
98.26	3.079	3.084	.102	.9999	10
116.27	3.075	3.082	.076	.9998	11
136.04	3.066	3.073	-6E-03	.9999	12
154.13	3.085	3.093	.19	.9999	13
175.67	3.077	3.086	.117	.9999	14
196.23	3.085	3.094	.203	.9998	15
217.84	3.088	3.098	.241	.9999	16
240.38	3.086	3.097	.23	.9999	17
265.26	3.076	3.088	.138	.9998	18
286.99	3.088	3.101	.265	.9998	19
311.51	3.088	3.102	.275	.9999	20
334.68	3.098	3.113	.391	.9999	21
357.04	3.115	3.131	.569	.9999	22
380.59	3.13	3.146	.72	.9998	23
403.6	3.143	3.16	.864	.9999	24
426.35	3.159	3.177	1.031	.9999	25
450.65	3.175	3.194	1.202	.9999	26
474.6	3.189	3.209	1.346	.9998	27
494.44	3.214	3.234	1.604	1	28
516.55	3.238	3.259	1.853	.9999	29
538.74	3.259	3.28	2.064	.9997	30
559.02	3.283	3.306	2.317	.9996	31
579.53	3.307	3.33	2.558	.9997	32
598	3.333	3.357	2.83	.9998	33

```
           LOAD(KN)        LOAD LINE DISPLACEMENT(MM)        J44
 1          5.432           0
 2          8.24            .043
 3          11.658          .095
 4          14.648          .155
 5          17.273          .229
 6          18.982          .334
 7          20.447          .448
 8          21.667          .565
 9          22.827          .687
 10         23.804          .811
 11         24.719          .939
 12         25.574          1.069
 13         26.306          1.205
 14         26.978          1.344
 15         27.588          1.483
 16         28.137          1.626
 17         28.625          1.769
 18         29.114          1.91
 19         29.48           2.056
 20         29.907          2.205
 21         30.09           2.355
 22         30.273          2.51
 23         30.273          2.668
 24         30.151          2.831
 25         30.273          2.99
 26         30.212          3.151
 27         29.846          3.323
 28         29.724          3.49
 29         29.602          3.657
 30         28.931          3.838
 31         28.442          4.015
 32         27.893          4.194
 33         27.344          4.376
 34         26.794          4.558
```

	J(KN/M)	T	W	J44
1	368.82	201.31	8.19	
2	392.09	205.82	7.82	
3	414.97	176.09	6.27	
4	438.5	183.38	6.12	
5	462.62	214.08	6.72	
6	484.52	98.99	2.93	
7	505.49	114.75	3.21	
8	527.64	135.72	3.59	
9	548.88	103.38	2.59	
10	569.27	109.84	2.62	
11	588.77	87.71	1.99	


SPECIMEN J45(250C)
SLOPE 106
INTERCEPT 114
J1C 131
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J45 (ALL DATA)


SPECIMEN J45
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J45
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            267.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          559.3
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             1.908
 PERCENT SIDE GROOVE                                  20.283
 SPECIMEN WIDTH W(CM)                                 3.81
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
 EFFECTIVE MODULUS(Pa)                                2.05100764E+11

                FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             16.95
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  2.226

                CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       2.309
 INITIAL A/W                                          .584
 AVERAGE CRACK EXTENSION 9PT(CM)                      .384
 DELTA A(CM) COMPLIANCE                               .375
 MAX DEVIATION OF SINGLE MEASUREMENT %                .96

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                        12
 LAST POINT                         19
 JIC(KN/M)                          131
 CORRELATION COEFF                  .99
 SLOPE M(MPa)                       106
 INTERCEPT B (KN/M)                 114

                VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD           YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD              YES

                QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      314.31
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    249.9
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.584
 25*JQ/EF.Y.(CM)                                      .792

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED          12
 LAST DATA POINT USED         26
 CONSTANT(C1)                 227.2
 EXPONENT(C2)                 .4703
```

J45(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
26.07	3.38	.03	3.41	3.41	3.55	2.24	1
33.8	5.69	2.52	8.21	8.21	8.51	2.228	2
40.11	8.01	8.2	16.21	16.24	16.58	2.244	3
44.34	9.79	17.2	26.99	26.97	27.51	2.237	4
47.46	11.22	28.33	39.55	39.46	40.18	2.232	5
51.08	12.99	40.3	53.29	53.57	53.93	2.247	6
53.5	14.25	54.56	68.81	68.78	69.58	2.238	7
55.79	15.49	69.79	85.29	85.57	86.09	2.245	8
57.45	16.43	86.51	102.94	102.95	103.83	2.241	9
60.13	18	101.65	119.66	121.19	120.49	2.262	10
61.91	19.09	119.46	138.55	140.52	139.42	2.267	11
62.93	19.72	139.23	158.95	161.36	159.81	2.271	12
65.27	21.21	156.59	177.8	182.18	178.63	2.288	13
67.05	22.38	175.2	197.58	203.97	198.36	2.303	14
68.35	23.26	195.35	218.61	226.66	219.34	2.314	15
70.03	24.42	212.39	236.81	249.95	237.38	2.344	16
71.35	25.35	232.23	257.58	274.62	258.03	2.364	17
72.01	25.81	253.16	278.97	299.9	279.27	2.383	18
72.86	26.43	274.88	301.31	325.45	301.51	2.397	19
72.75	26.35	295.09	321.44	352.21	321.4	2.424	20
72.42	26.11	313.59	339.7	378.97	339.38	2.455	21
73.22	26.69	331.03	357.73	403.94	357.26	2.479	22
74.38	27.54	345.37	372.91	428.8	372.3	2.51	23
74.86	27.9	360.44	388.34	454.29	387.54	2.54	24
74.67	27.76	374.08	401.84	479.86	400.83	2.574	25
75.2	28.15	388.26	416.41	504.68	415.24	2.601	26

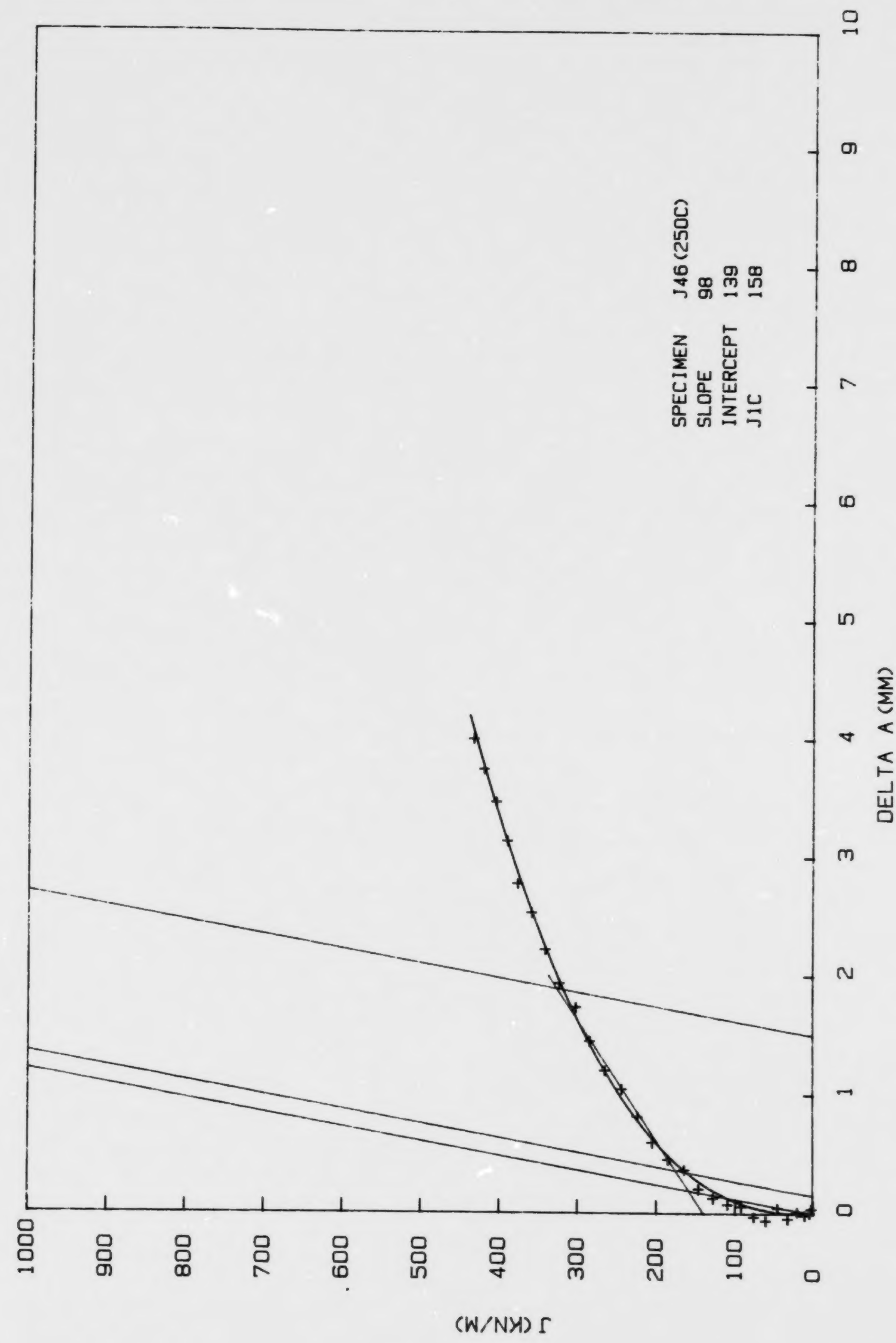
H(M)	D(M)	POISSON'S RATIO
.01429	2.54E-03	.3

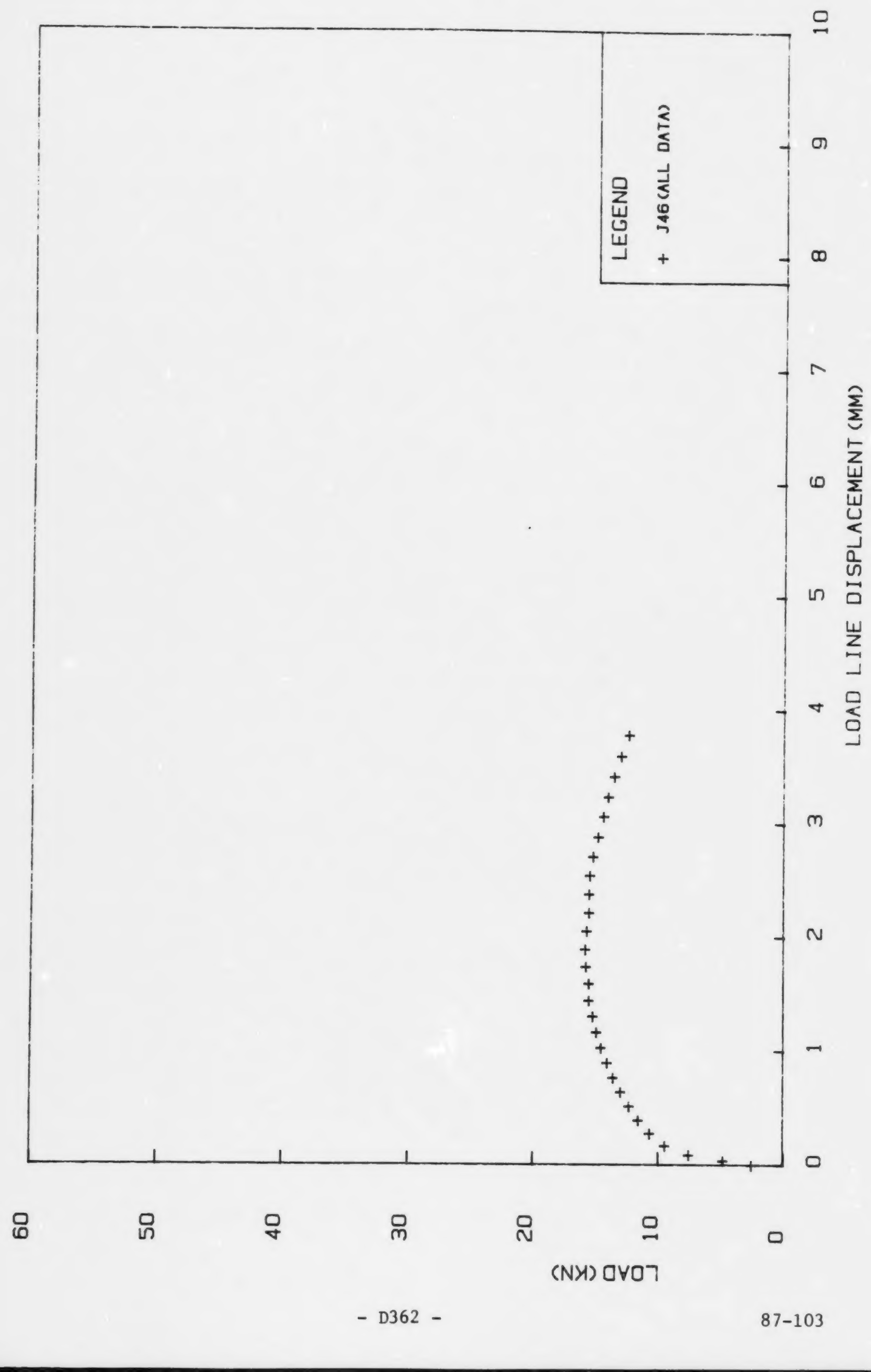
J45

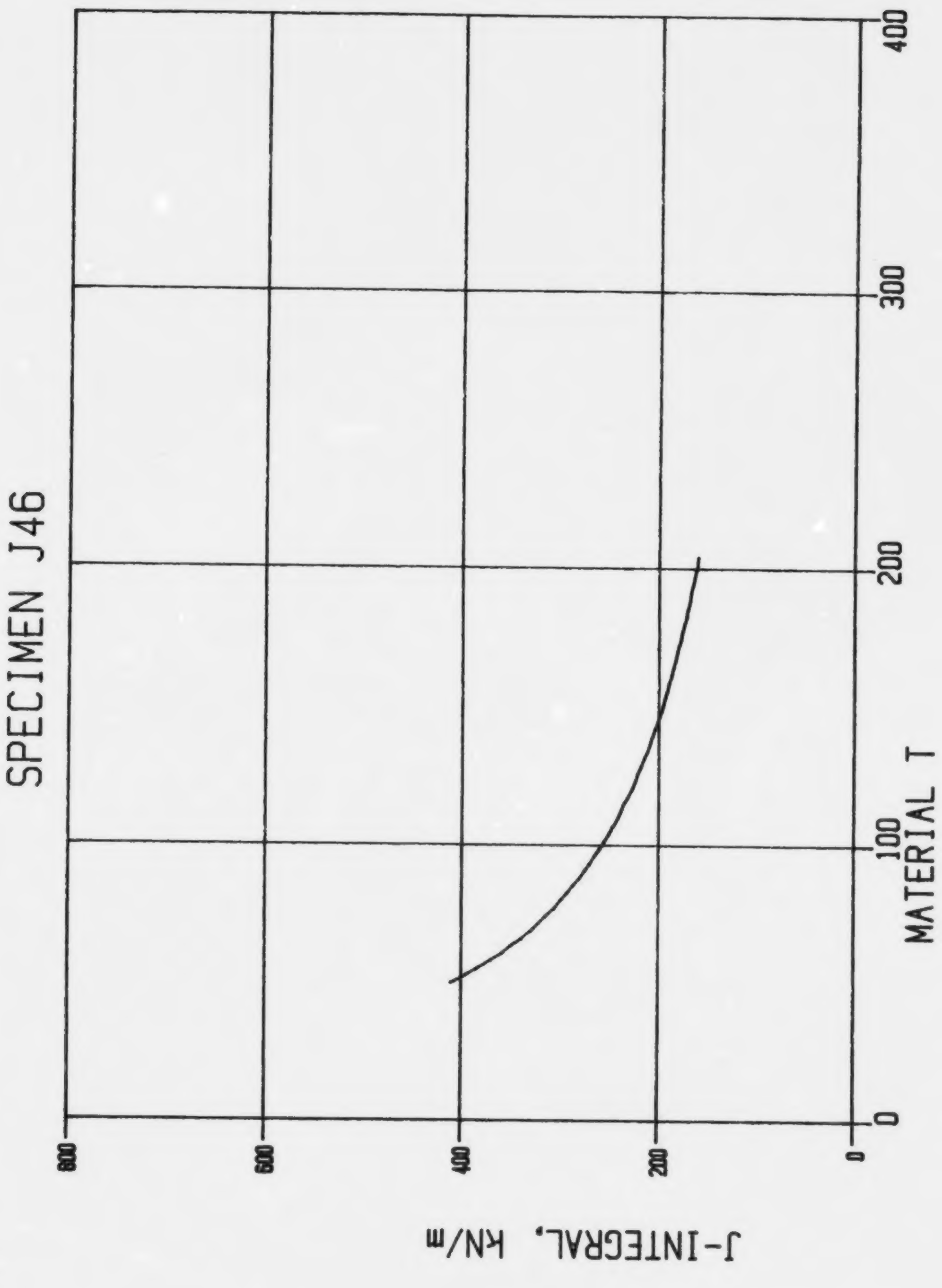
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
3.41	2.24	2.24	.138	.9998	1
8.21	2.227	2.228	.019	.9992	2
16.21	2.243	2.244	.179	.9995	3
26.99	2.235	2.237	.106	.9996	4
39.55	2.229	2.232	.059	.9995	5
53.29	2.244	2.247	.213	.9997	6
68.81	2.234	2.238	.123	.9992	7
85.29	2.24	2.245	.191	.9994	8
102.94	2.235	2.241	.146	.9996	9
119.66	2.255	2.262	.355	.9995	10
138.55	2.259	2.267	.405	.9999	11
158.95	2.262	2.271	.449	.9995	12
177.8	2.278	2.288	.616	.9998	13
197.58	2.292	2.303	.765	.9997	14
218.61	2.303	2.314	.876	.9997	15
236.81	2.332	2.344	1.176	.9998	16
257.58	2.352	2.364	1.385	.9997	17
278.97	2.37	2.383	1.572	.9998	18
301.31	2.383	2.397	1.713	.9999	19
321.44	2.409	2.424	1.979	.9998	20
339.7	2.44	2.455	2.292	.9994	21
357.73	2.462	2.479	2.528	.9995	22
372.91	2.493	2.51	2.835	.9998	23
388.34	2.522	2.54	3.136	.9998	24
401.84	2.556	2.574	3.475	.9994	25
416.41	2.582	2.601	3.747	.9987	26

```
                LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J45
 1               4.333         0
 2               6.653         .042
 3               8.728         .11
 4              10.193         .205
 5              11.353         .313
 6              12.207         .427
 7              12.939         .552
 8              13.672         .674
 9              14.16          .806
 10             14.648         .935
 11             15.015         1.072
 12             15.381         1.208
 13             15.564         1.353
 14             15.869         1.497
 15             16.052         1.643
 16             16.174         1.792
 17             16.052         1.948
 18             15.991         2.109
 19             15.808         2.273
 20             15.747         2.437
 21             15.259         2.612
 22             14.648         2.793
 23             14.404         2.961
 24             14.099         3.132
 25             13.672         3.308
 26             13.062         3.489
 27             12.695         3.665
```

	J(KN/M)	T	W	J45
1	129.1	402.66	44.99	
2	148.75	496.19	47.98	
3	168.37	121.19	10.24	
4	187.69	141.76	10.64	
5	208.1	203.37	13.67	
6	227.71	64.88	3.9	
7	247.19	106.55	5.82	
8	268.27	121.91	6.06	
9	290.14	169.76	7.72	
10	311.37	81.14	3.38	
11	330.57	62.36	2.39	
12	348.71	81.82	2.92	
13	365.32	52.85	1.76	
14	380.63	54.86	1.71	
15	395.09	42.57	1.25	
16	409.13	57.34	1.58	


SPECIMEN J46(250C)
SLOPE 98
INTERCEPT 139
J1C 158
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J46 (ALL DATA)


SPECIMEN J46
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
      DATA SHEET-J1-R CURVE TEST

              TEST SPECIMEN DATA

  SPECIMEN NUMBER                                       J46
  MATERIAL TYPE                                         A106B
  MATERIAL CONDITION                                    PARENT
  TEST TEMPERATURE(DEG C)                               250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             267.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           559.3
  CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
  SPECIMEN THICKNESS B(CM)                              1.906
  PERCENT SIDE GROOVE                                   21.038
  SPECIMEN WIDTH W(CM)                                  3.809
  YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
  EFFECTIVE MODULUS(Pa)                                 2.0614689E+11

              FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              17
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                   2.227

              CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                        2.304
  INITIAL A/W                                           .585
  AVERAGE CRACK EXTENSION 9PT(CM)                       .412
  DELTA A(CM) COMPLIANCE                                .4
  MAX DEVIATION OF SINGLE MEASUREMENT %                 .93

              ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                      13
  LAST POINT                       20
  JIC(KN/M)                        158
  CORRELATION COEFF                .98
  SLOPE M(MPa)                     98
  INTERCEPT B (KN/M)               139

              VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD         YES
  LIGAMENT>25JIC/EFFECTIVE YIELD   YES
  DJ/DA<EFFECTIVE YIELD            YES

              QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                              NO
  CRACK SIZE DA<0.15*DELTA A                            YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       311.01
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     244.22
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      1.582
  25*JQ/EF.Y.(CM)                                       .956

              CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED        13
  LAST DATA POINT USED       28
  CONSTANT(C1)               247.04
  EXPONENT(C2)               .401
```

```
          J46(250C)

 K          J-ELASTIC     J-PLASTIC     JEL+JPL      J(M)       J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)         (KN/M)       (KN/M)     (KN/M)         (KN/M)       (CM)

18.86       1.77          -.03          1.74        1.74         1.84     2.231   1
29.51       4.34          .08           4.41        4.41         4.68     2.228   2
36.81       6.75          3.92          10.67       10.67        11.09    2.226   3
41.68       8.65          11.7          20.35       20.36        20.88    2.229   4
44.99       10.08         22.48         32.55       32.51        33.2     2.223   5
48.27       11.6          34.12         45.72       45.85        46.42    2.232   6
50.36       12.63         48.24         60.87       60.68        61.69    2.222   7
52.89       13.93         62.35         76.28       76.23        77.16    2.225   8
55.27       15.21         77.04         92.25       92.65        93.15    2.234   9
57.27       16.33         93.39         109.72      110.22       110.68   2.235   10
59.02       17.34         110.67        128.01      128.92       129      2.24    11
60.69       18.34         128.43        146.76      148.4        147.75   2.248   12
62.91       19.71         145.04        164.74      168.11       165.7    2.264   13
63.46       20.05         165.44        185.49      189.9        186.39   2.273   14
65.4        21.29         184.06        205.35      211.75       206.22   2.287   15
67.17       22.47         201.76        224.22      234.1        224.99   2.309   16
68.3        23.23         221.04        244.26      258.18       244.88   2.332   17
68.64       23.46         242.24        265.7       282.63       266.19   2.348   18
70.5        24.75         260.19        284.94      307.14       285.31   2.372   19
72.48       26.16         276.78        302.94      331.78       303.19   2.401   20
72.99       26.52         297.33        323.85      357.78       323.94   2.421   21
73.33       26.77         315.39        342.16      383.92       342.02   2.45    22
73.87       27.17         332.31        359.48      410.39       359.13   2.481   23
74.16       27.38         350.16        377.54      436.23       377.01   2.505   24
74.83       27.88         363.08        390.96      461.81       390.26   2.541   25
74.88       27.92         377.33        405.24      487.93       404.32   2.574   26
73.98       27.25         393.71        420.96      514.16       419.79   2.602   27
75.42       28.32         406.07        434.39      537.93       433.14   2.627   28

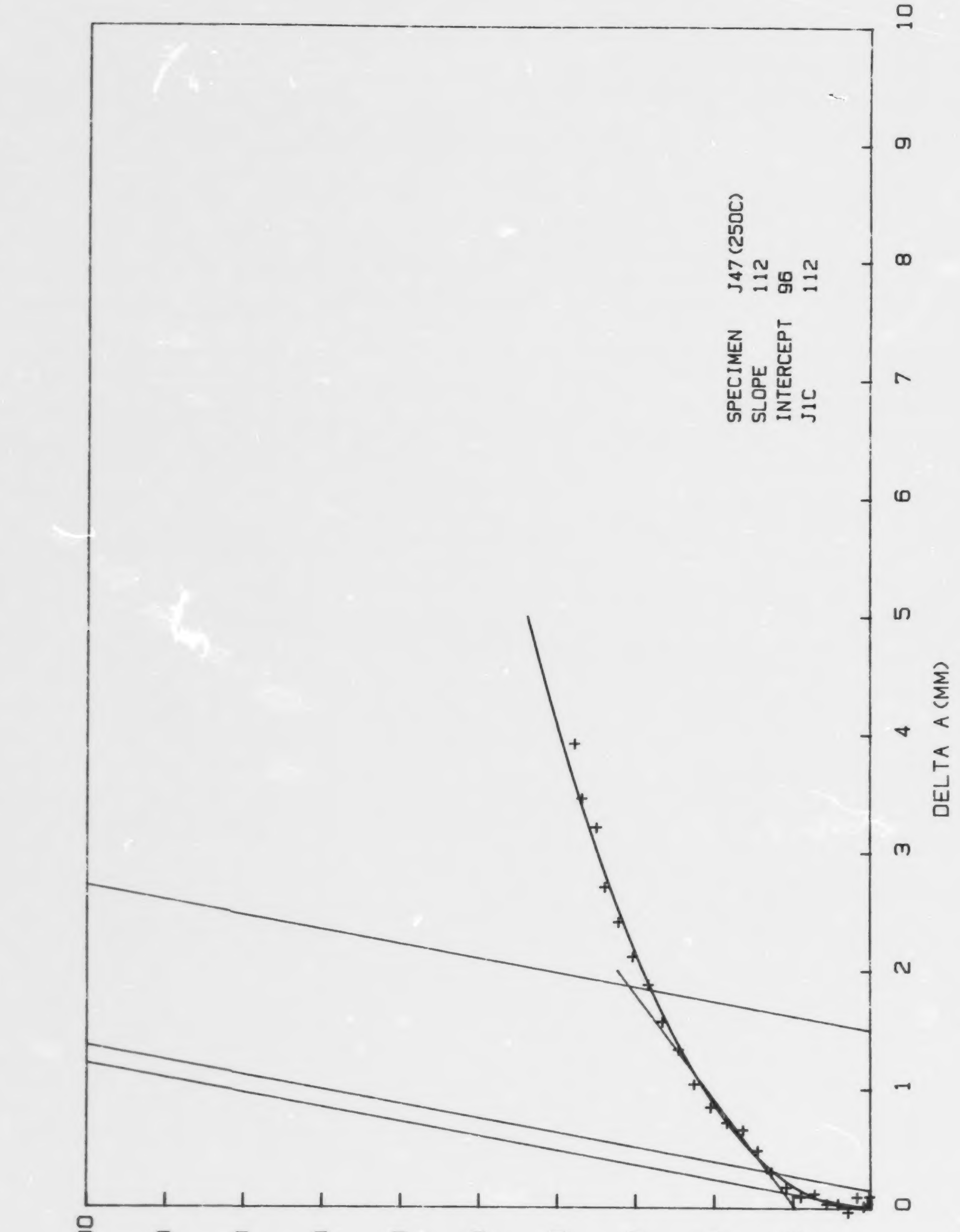
H(M)            D(M)            POISSON'S RATIO
.01431          2.54E-03        .3
```

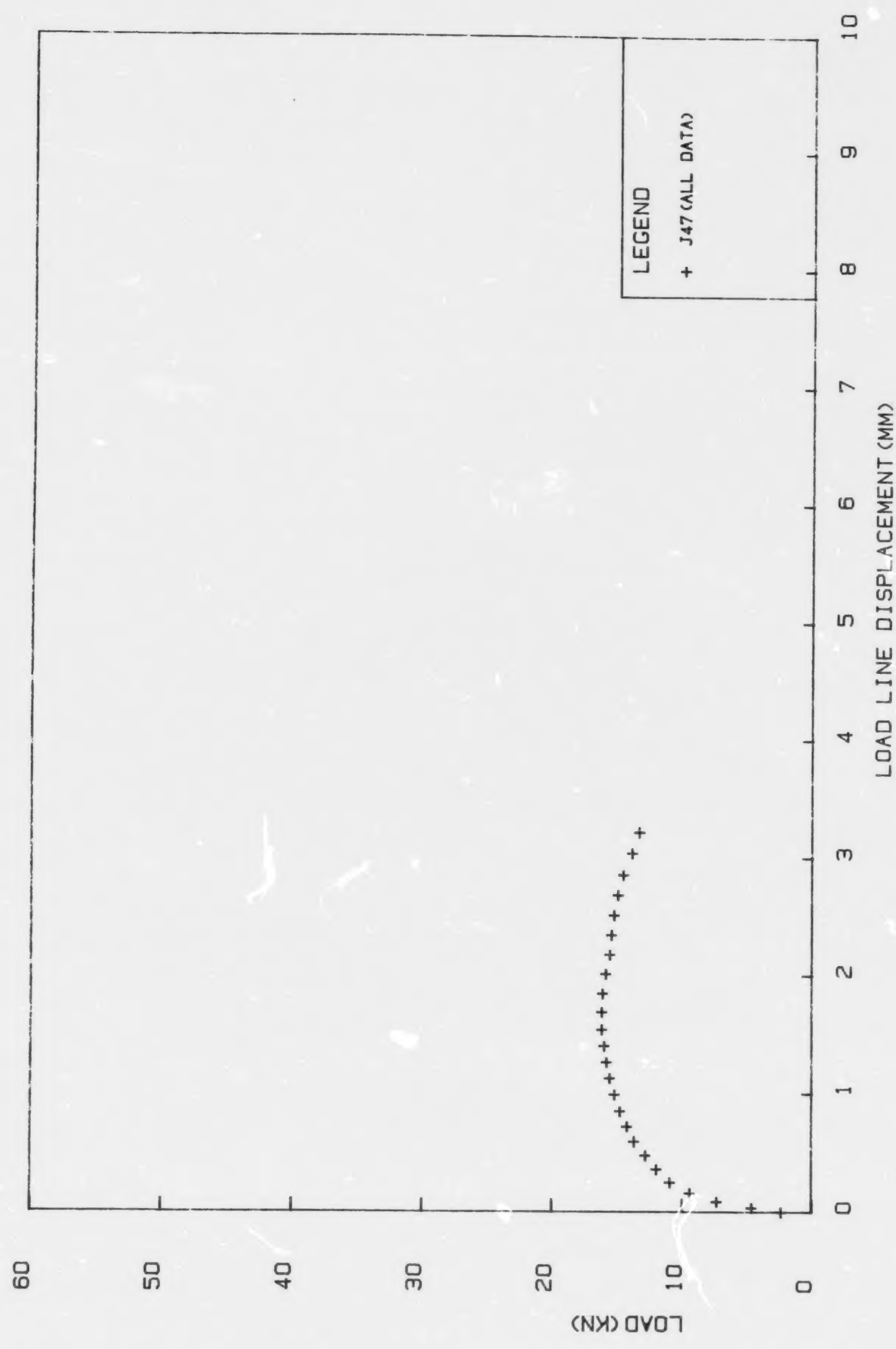
J46

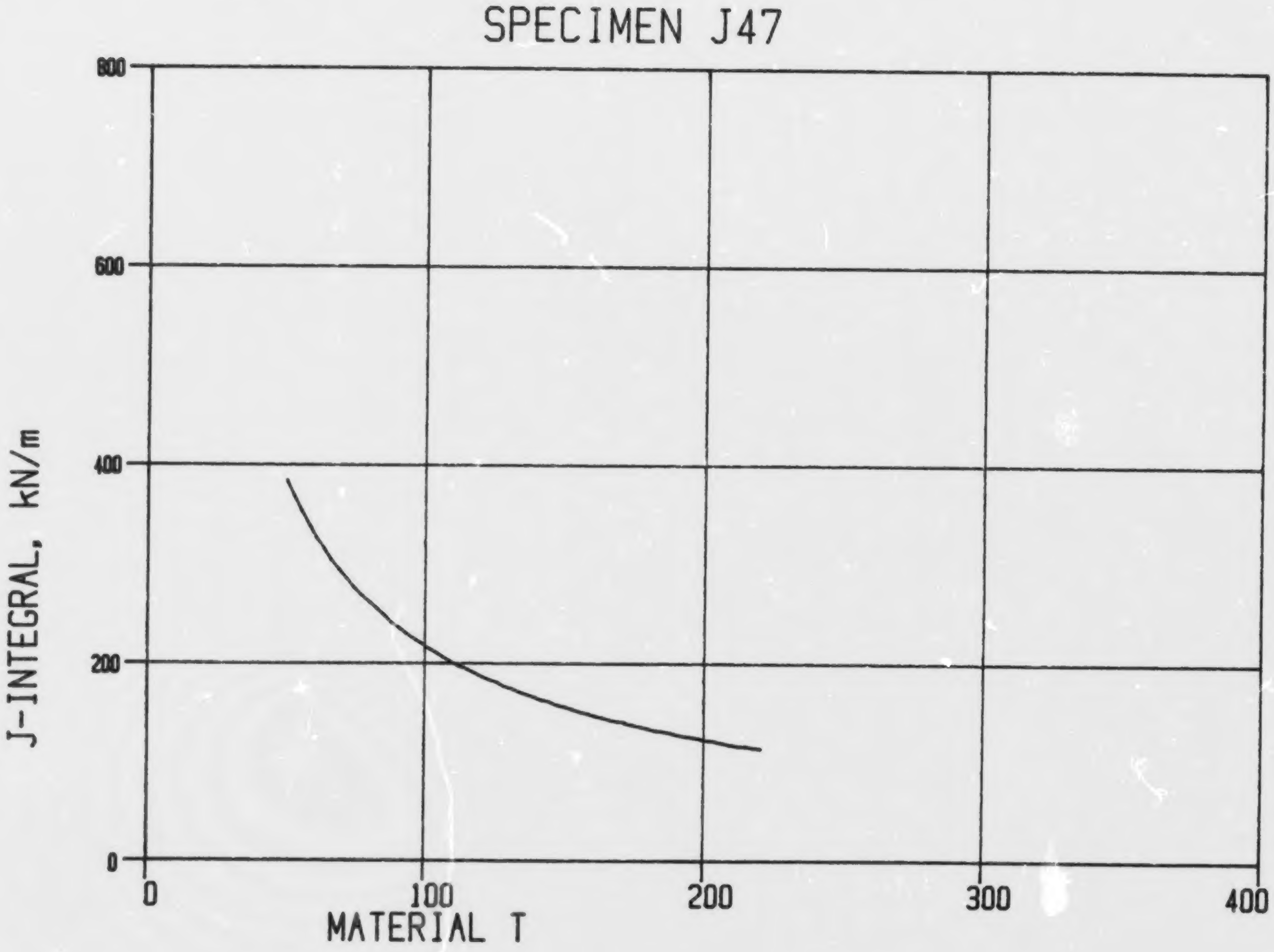
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.74	2.231	2.231	.043	.9995	1
4.41	2.228	2.228	.011	.9996	2
10.67	2.225	2.226	-9E-03	.9997	3
20.35	2.227	2.229	.019	.9999	4
32.55	2.221	2.223	-.039	.9998	5
45.72	2.229	2.232	.053	.9997	6
60.87	2.217	2.222	-.055	.9999	7
76.28	2.22	2.225	-.023	.9998	8
92.25	2.228	2.234	.065	.9996	9
109.72	2.228	2.235	.08	.9998	10
128.01	2.233	2.24	.134	.9995	11
146.76	2.24	2.248	.211	.9996	12
164.74	2.255	2.264	.372	.9998	13
185.49	2.263	2.273	.457	.9995	14
205.35	2.276	2.287	.598	.9999	15
224.22	2.297	2.309	.819	.9998	16
244.26	2.319	2.332	1.05	.9999	17
265.7	2.334	2.348	1.206	.9999	18
284.94	2.358	2.372	1.452	.9997	19
302.94	2.386	2.401	1.737	.9999	20
323.85	2.405	2.421	1.939	.9998	21
342.16	2.433	2.45	2.225	.9997	22
359.48	2.464	2.481	2.536	.9998	23
377.54	2.488	2.505	2.781	.9997	24
390.96	2.523	2.541	3.141	.9996	25
405.24	2.556	2.574	3.47	.9998	26
420.96	2.583	2.602	3.746	.9999	27
434.39	2.608	2.627	4.002	.9997	28

```
                LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J46
 1               2.502         0
 2               4.822          .039
 3               7.568          .088
 4               9.46           .168
 5              10.681          .273
 6              11.597          .391
 7              12.329          .513
 8              13              .637
 9              13.611          .764
 10             14.099          .894
 11             14.587         1.025
 12             14.954         1.162
 13             15.259         1.301
 14             15.564         1.44
 15             15.564         1.589
 16             15.808         1.738
 17             15.869         1.89
 18             15.747         2.051
 19             15.564         2.212
 20             15.564         2.375
 21             15.503         2.539
 22             15.259         2.708
 23             14.832         2.881
 24             14.404         3.059
 25             14.038         3.232
 26             13.55          3.411
 27             13             3.594
 28             12.39          3.779
 29             12.207         3.95
```

	J(KN/M)	T	W	J46
1	155.75	119.84	11.11	
2	175.12	260.14	21.33	
3	195.42	150.29	10.94	
4	214.78	91.37	5.96	
5	234.24	92.95	5.48	
6	254.98	147.38	7.89	
7	275.32	83.54	4.07	
8	293.94	67.62	3.03	
9	313.4	110.9	4.59	
10	333	68.36	2.61	
11	350.82	59.74	2.11	
12	368.51	78.71	2.6	
13	384.25	39.94	1.23	
14	398.1	46.33	1.34	
15	413.1	60.95	1.66	
16	427.68	56.2	1.45	

SPECIMEN J47 (250C)
SLOPE 112
INTERCEPT 96
J1C 112
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J47 (ALL DATA)



SPECIMEN J47

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                    J47
  MATERIAL TYPE                                      A106B
  MATERIAL CONDITION                                 PARENT
  TEST TEMPERATURE(DEG C)                            250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          267.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        559.3
  CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
  SPECIMEN THICKNESS B(CM)                           1.905
  PERCENT SIDE GROOVE                                20.209
  SPECIMEN WIDTH W(CM)                               3.809
  YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
  EFFECTIVE MODULUS(Pa)                              2.06865662E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN              5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           16.93
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                2.222

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                     2.307
  INITIAL A/W                                        .583
  AVERAGE CRACK EXTENSION 9PT(CM)                    .377
  DELTA A(CM) COMPLIANCE                             .392
  MAX DEVIATION OF SINGLE MEASUREMENT %              .93

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                    11
  LAST POINT                     18
  JIC(KN/M)                      112
  CORRELATION COEFF              .97
  SLOPE M(MPa)                   112
  INTERCEPT B (KN/M)             96

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD       YES
  LIGAMENT>25JIC/EFFECTIVE YIELD YES
  DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                           YES
  CRACK SIZE DA<0.15*DELTA A                         YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    314.11
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  246.99
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   1.587
  25*JQ/EF.Y.(CM)                                    .677

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       11
  LAST DATA POINT USED      25
  CONSTANT(C1)              212.39
  EXPONENT(C2)              .4507
```
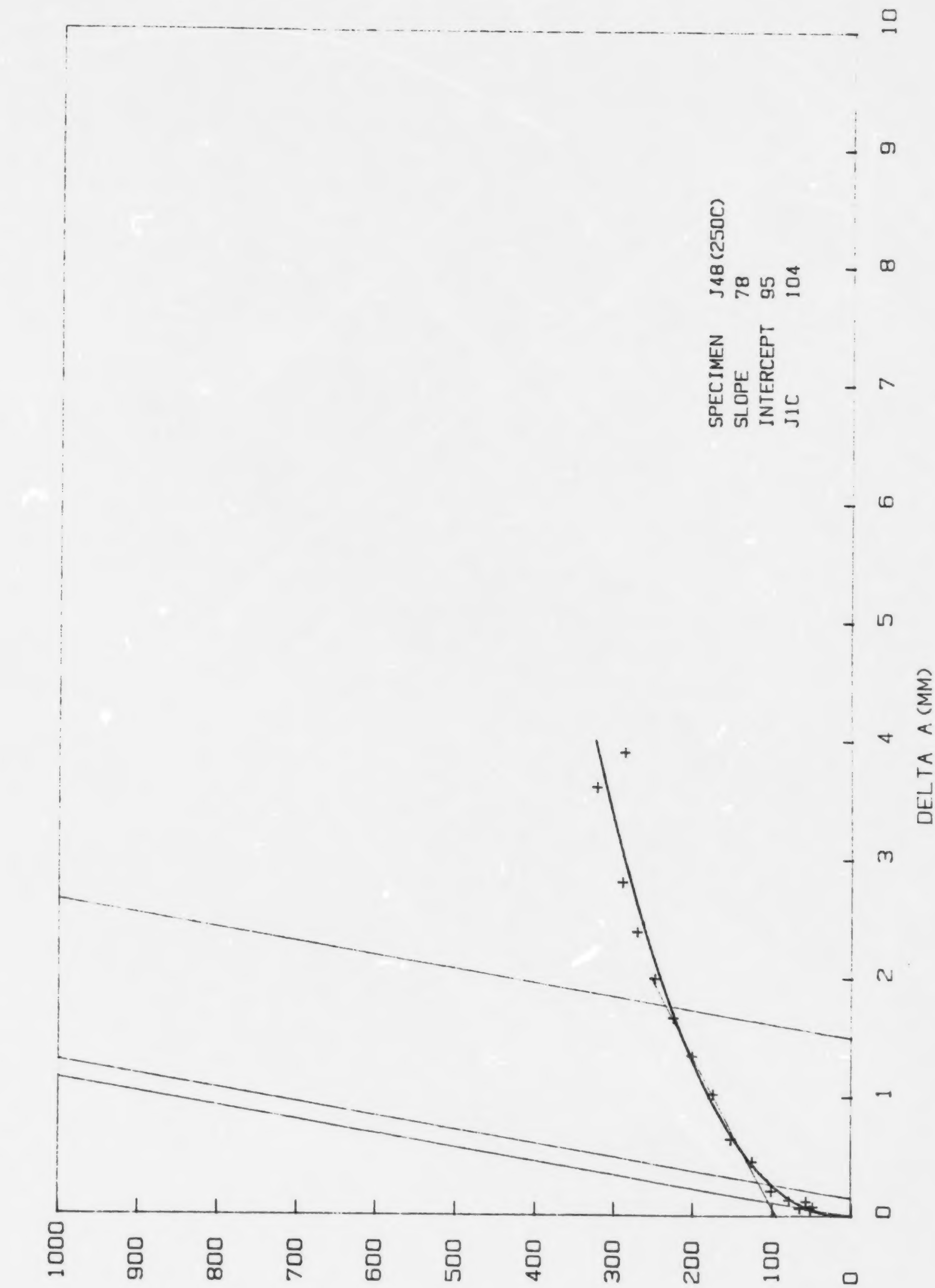

```
           J47(250C)

 K          J-ELASTIC      J-PLASTIC      JEL+JPL      J(M)         J(TO.AREA)  CR. LN
 (MPaRTM)   (KN/M)         (KN/M)         (KN/M)      (KN/M)          (KN/M)       (CM)

 18.07      1.63           -.08           1.55        1.55          1.62     2.232  1
 28.37      4.01           .25            4.26        4.26          4.48     2.226  2
 36.32      6.57           3.01           9.58        9.58          9.96     2.224  3
 42.54      9.01           9.01           18.02       18.04         18.51    2.232  4
 46         10.54          19.27          29.8        29.73         30.45    2.219  5
 49.63      12.26          30.27          42.54       42.57         43.24    2.226  6
 52.93      13.95          43.09          57.04       57.07         57.85    2.226  7
 55.52      15.35          57.45          72.8        73.14         73.63    2.234  8
 57.51      16.47          73.82          90.29       90.49         91.2     2.232  9
 59.66      17.72          91.06          108.79      109.5         109.71   2.24   10
 61.86      19.05          108.29         127.34      129           128.25   2.252  11
 64.01      20.4           124.76         145.16      148.49        146.02   2.271  12
 65.9       21.62          141.72         163.34      168.48        164.15   2.288  13
 67.09      22.41          161.3          183.71      189.62        184.51   2.294  14
 68         23.02          181.55         204.57      212.28        205.3    2.307  15
 69.13      23.79          201.44         225.24      235.97        225.85   2.326  16
 70.24      24.57          220.41         244.97      260.83        245.38   2.355  17
 70.69      24.88          240.57         265.45      285.93        265.67   2.379  18
 72.63      26.27          257.13         283.4       310.64        283.46   2.41   19
 73.75      27.08          276.37         303.45      336.31        303.35   2.434  20
 74.76      27.82          293.98         321.81      362.08        321.52   2.463  21
 75.24      28.18          310.98         339.16      387.66        338.67   2.493  22
 76.35      29.02          320.9          349.92      413.43        349.26   2.543  23
 75.63      28.48          339.95         368.43      439.69        367.51   2.567  24
 75.57      28.44          349.29         377.73      464.83        376.64   2.614  25

 H(M)             D(M)             POISSON'S RATIO
 .0143            2.54E-03         .3
```

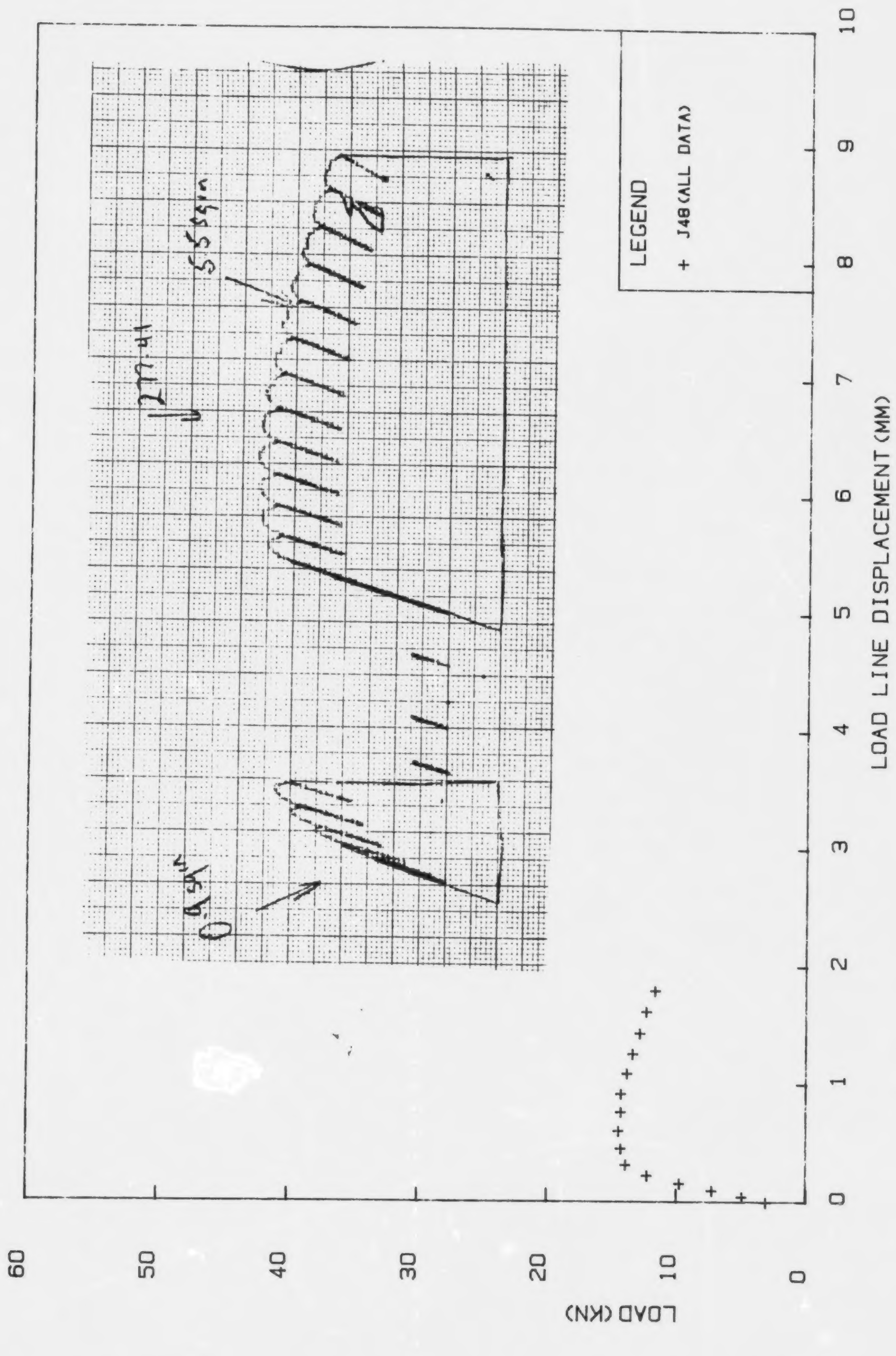
J47

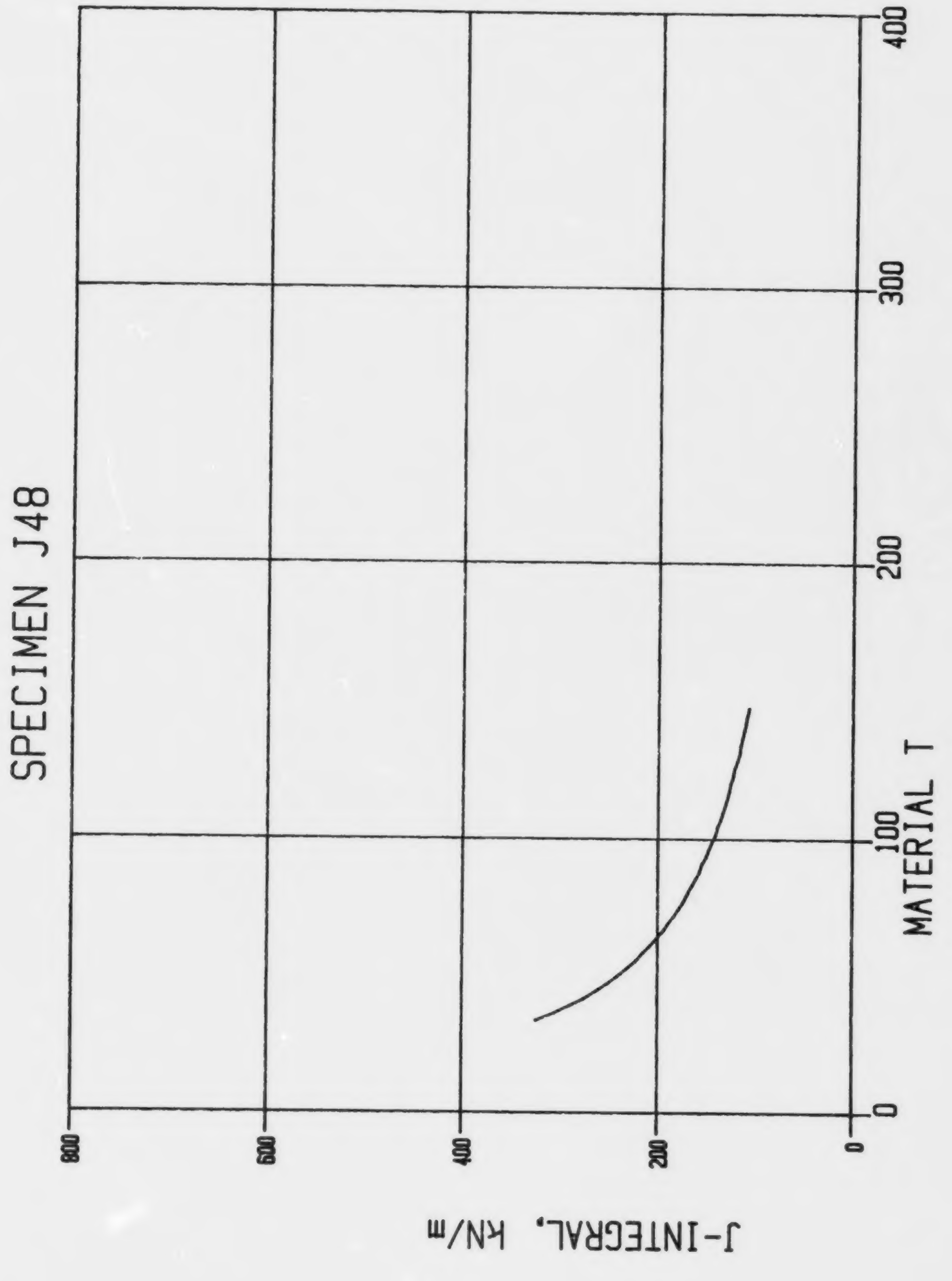
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.55	2.232	2.232	.101	.9993	1
4.26	2.226	2.226	.042	.9995	2
9.58	2.223	2.224	.017	.9998	3
18.02	2.23	2.232	.095	.9997	4
29.8	2.217	2.219	-.031	.9998	5
42.54	2.223	2.226	.039	.9997	6
57.04	2.222	2.226	.038	.9996	7
72.8	2.23	2.234	.122	.9999	8
90.29	2.226	2.232	.095	.9999	9
108.79	2.233	2.24	.178	.9998	10
127.34	2.245	2.252	.302	.9999	11
145.16	2.263	2.271	.485	.9997	12
163.34	2.279	2.288	.656	.9998	13
183.71	2.284	2.294	.72	.9998	14
204.57	2.296	2.307	.849	.9998	15
225.24	2.315	2.326	1.041	.9998	16
244.97	2.343	2.355	1.333	.9997	17
265.45	2.366	2.379	1.569	.9998	18
283.4	2.397	2.41	1.882	.9997	19
303.45	2.42	2.434	2.121	.9999	20
321.81	2.448	2.463	2.41	.9999	21
339.16	2.477	2.493	2.707	.9998	22
349.92	2.527	2.543	3.21	.9997	23
368.43	2.551	2.567	3.454	.9999	24
377.73	2.597	2.614	3.918	.9999	25

```
           LOAD(KN)        LOAD LINE DISPLACEMENT(MM)        J47
 1          2.319           0
 2          4.639           .037
 3          7.324           .088
 4          9.399           .159
 5          10.925          .251
 6          11.963          .361
 7          12.817          .476
 8          13.672          .596
 9          14.221          .723
 10         14.771          .852
 11         15.198          .991
 12         15.564          1.13
 13         15.808          1.267
 14         15.991          1.404
 15         16.174          1.543
 16         16.174          1.692
 17         16.113          1.848
 18         15.869          2.014
 19         15.564          2.18
 20         15.442          2.346
 21         15.259          2.515
 22         14.954          2.686
 23         14.526          2.856
 24         13.855          3.04
 25         13.306          3.218
 26         12.512          3.403
```

	J(KN/M)	T	W	J47
1	118.06	160.69	19.8	
2	136.25	103.93	10.97	
3	154.25	113.54	10.47	
4	173.52	343.79	28.05	
5	194.14	172.62	12.48	
6	214.9	115.03	7.42	
7	235.1	72.41	4.18	
8	255.21	92.91	4.87	
9	274.42	61.28	2.92	
10	293.42	89.98	3.94	
11	312.63	67.86	2.73	
12	330.48	62.55	2.33	
13	344.54	22.86	.79	
14	359.18	81.25	2.62	
15	373.08	21.44	.64	


SPECIMEN J48(250C)
SLOPE 78
INTERCEPT 95
J1C 104
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J48(ALL DATA)
0.95in
2.77 in
5.55in


SPECIMEN J48
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

ATTACHMENT A2

TEST SPECIMEN DATA

SPECIMEN NUMBER	J48
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN107)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	324
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	548.2
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	1.589
PERCENT SIDE GROOVE	20.767
SPECIMEN WIDTH W(CM)	3.81
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.02480749E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	22.39
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.32

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	2.386
INITIAL A/W	.609
AVERAGE CRACK EXTENSION 9PT(CM)	.342
DELTA A(CM) COMPLIANCE	.36
MAX DEVIATION OF SINGLE MEASUREMENT %	3.5

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	7
LAST POINT	11
JIC(KN/M)	~~54~~ 104
CORRELATION COEFF	.99
SLOPE M(MPa)	78
INTERCEPT B (KN/M)	~~49~~ 95

Note: Specimen J48 was inadvertently prestrained before testing. Therefore, this data should not be used in any analysis. Results from companion specimens J49 and J50 remain unchanged.

The J_{Ic} value and the constants C_1 and C_2 for the J resistance curve have been corrected by adding the J from the non prestrained specimen to the prestrained J values. This is only an approximate correction.

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	274.52
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	246.32
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.49
25*JQ/EF.Y.(CM)	.31

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	7
LAST DATA POINT USED	15
CONSTANT(C1)	~~131.56~~ 179.36
EXPONENT(C2)	~~.5511~~ .4280

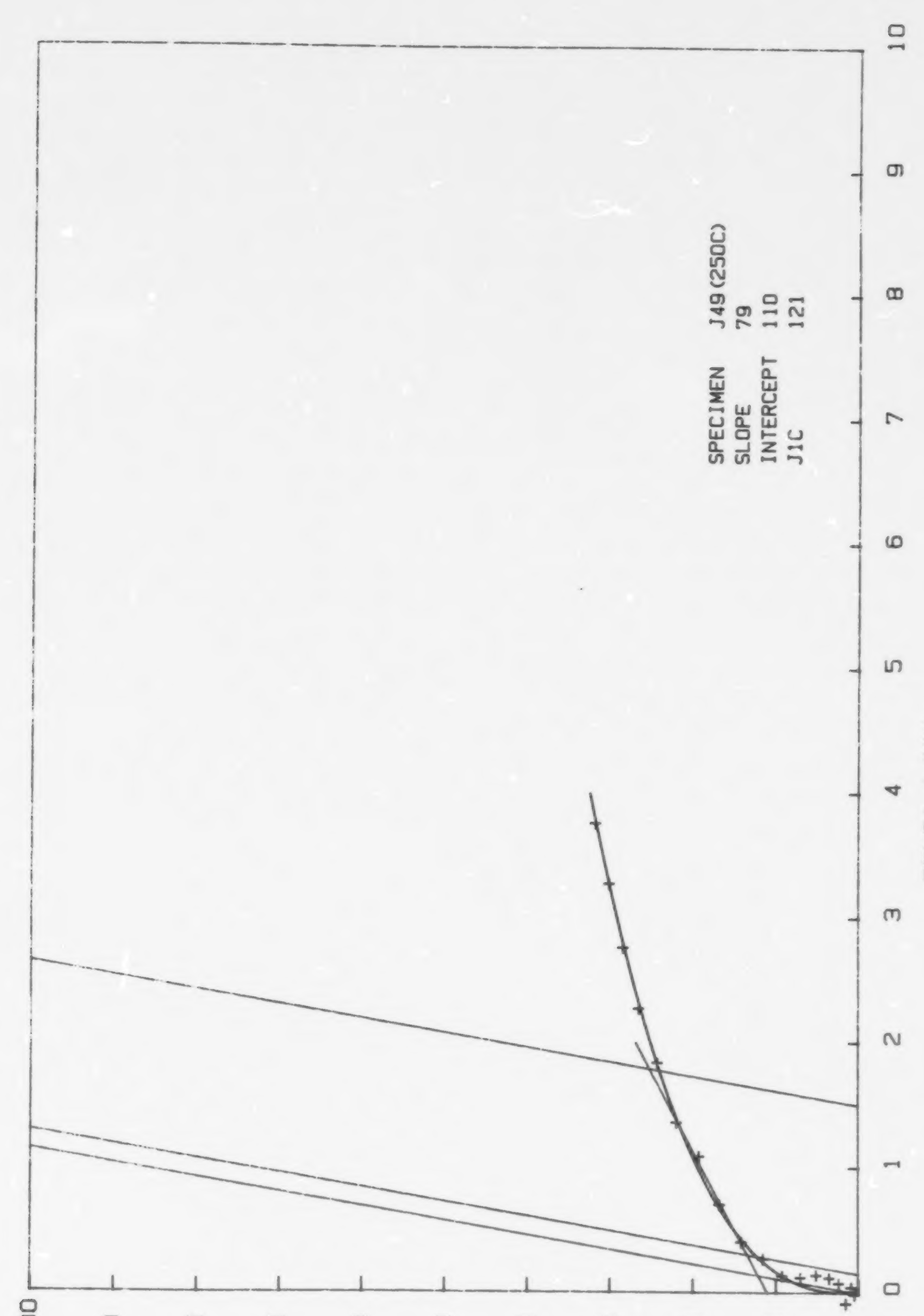
```
           J48(250C)

 K           J-ELASTIC       J-PLASTIC      JEL+JPL      J(M)        J(TO.AREA)   CR. LN
 (MPaRTM)    (KN/M)           (KN/M)         (KN/M)     (KN/M)         (KN/M)         (CM)

 25.55       3.25             .02            3.28        3.28         3.46       2.328   1
 37.44       6.98            -.08            6.9         6.9          7.34       2.326   2
 50.71       12.8            -.48            12.33       12.33        13.15      2.333   3
 63.3        19.95            .57            20.52       20.52        21.86      2.327   4
 72.35       26.06           7.81            33.87       33.88        35.59      2.334   5
 74.85       27.89           28.79           56.69       56.74        58.45      2.341   6
 77.86       30.19           50.27           80.46       81.14        82.1       2.366   7
 78.45       30.64           76.2            106.84      108.35       108.29     2.384   8
 81.88       33.38           95.92           129.3       133.42       130.53     2.422   9
 82.04       33.51           121.97          155.48      162.42       156.3      2.454   10
 82.56       33.94           145.22          179.16      189.74       179.64     2.486   11
 82.41       33.81           169.27          203.08      218.24       203.16     2.519   12
 83.29       34.54           190.79          225.32      246.99       224.99     2.559   13
 83.15       34.42           210.13          244.55      274.2        243.8      2.601   14
 91.68       41.85           200.24          242.08      295.31       242        2.71    15
 83.99       35.12           242.29          277.41      324.08       277.42     2.68    16

 H(M)             D(M)             POISSON'S RATIO
 .01426           2.54E-03         .3
```

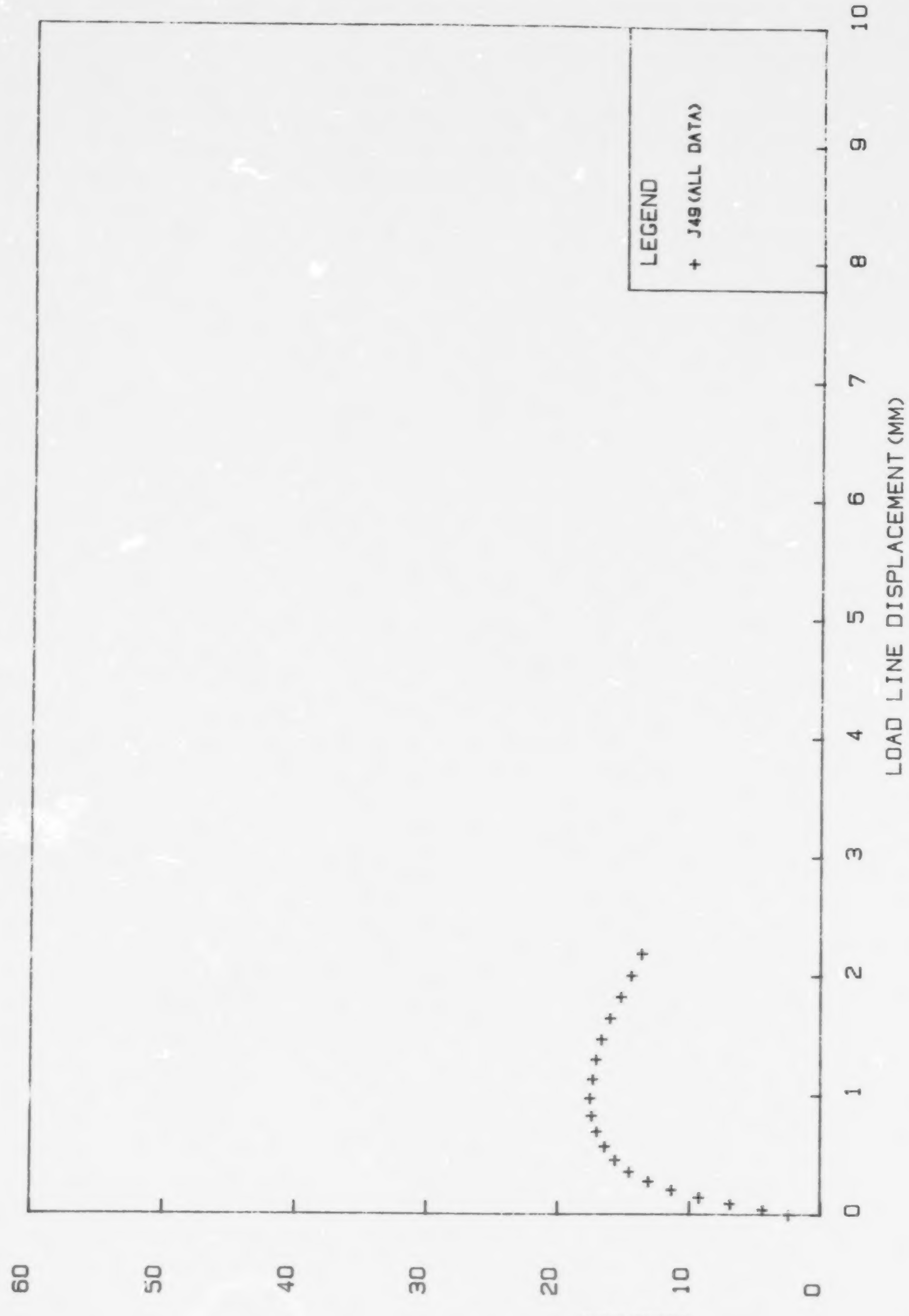
J48

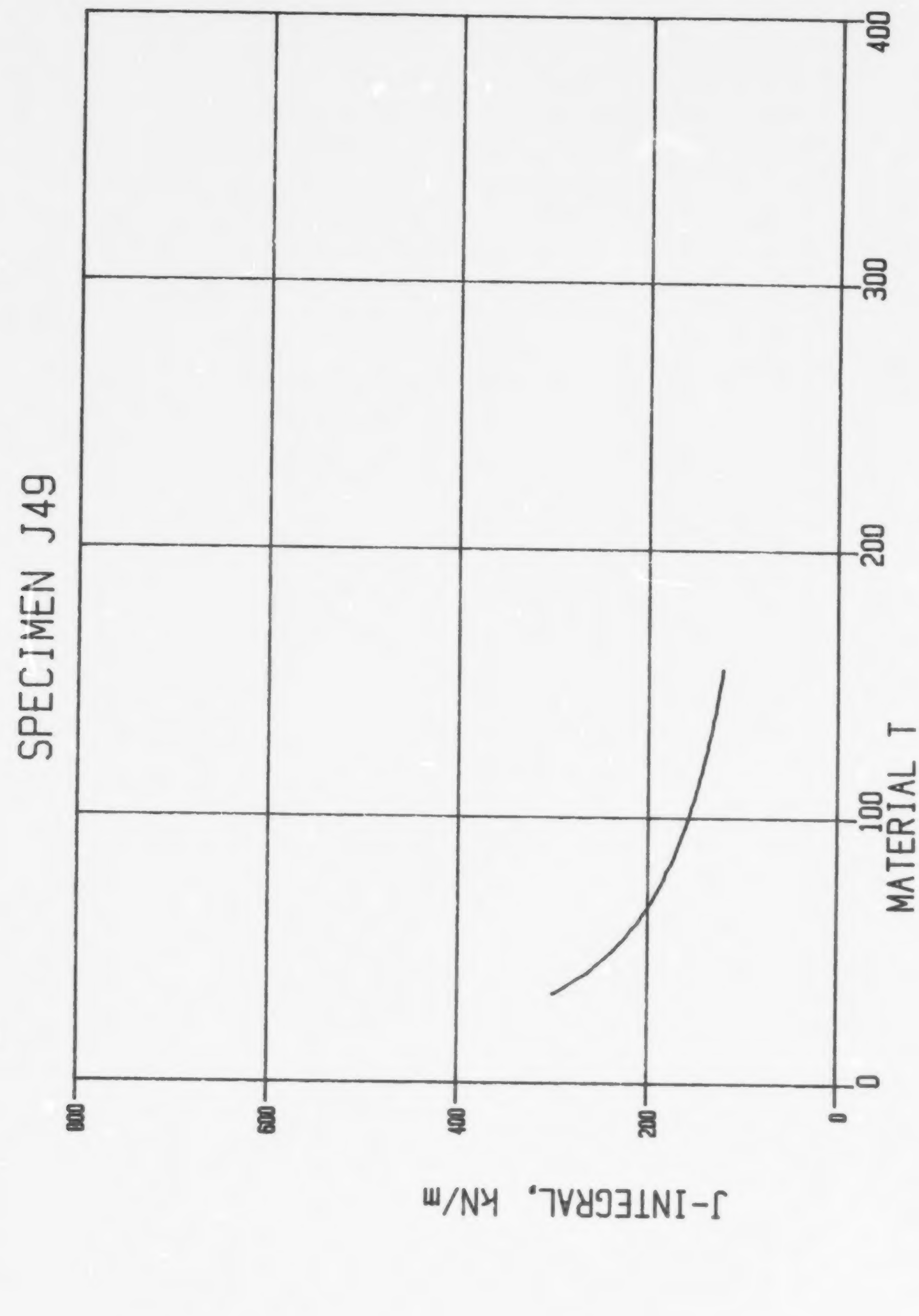
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
3.28	2.328	2.328	.082	.9998	1
6.9	2.325	2.326	.058	.9998	2
12.33	2.332	2.333	.125	.9997	3
20.52	2.325	2.327	.066	.9998	4
33.87	2.332	2.334	.137	.9999	5
56.69	2.339	2.341	.212	.9999	6
80.46	2.363	2.366	.459	.9998	7
106.84	2.38	2.384	.643	.9998	8
129.3	2.417	2.422	1.024	.9998	9
155.48	2.449	2.454	1.343	.9998	10
179.16	2.48	2.486	1.662	.9997	11
203.08	2.512	2.519	1.992	.9997	12
225.32	2.551	2.559	2.386	.9998	13
244.55	2.592	2.601	2.806	.9998	14
242.08	2.702	2.71	3.899	.5625	15
277.41	2.671	2.68	3.603	.9999	16

```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J48
 1          3.052          0
 2          4.944          .046
 3          7.263          .1
 4          9.766          .159
 5          12.268         .225
 6          13.916         .315
 7          14.282         .454
 8          14.465         .603
 9          14.282         .764
 10         14.282         .918
 11         13.794         1.091
 12         13.367         1.257
 13         12.817         1.433
 14         12.329         1.616
 15         11.658         1.794
 16         11.047         1.973
 17         10.559         2.131
```

	J(KN/M)	T	W	J48
1	45.28	292.81	98.84	
2	68.57	92.3	20.22	
3	93.65	137.63	21.8	
4	118.07	56.72	6.94	
5	142.39	78.88	7.81	
6	167.32	71.33	5.87	
7	191.12	69.74	4.9	
8	214.2	54.13	3.29	
9	234.94	44.07	2.36	
10	243.32	-2.17	-.1	
11	259.75	-114.93	-5.2	


SPECIMEN J49 (250C)
SLOPE 79
INTERCEPT 110
J1C 121
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J49 (ALL DATA)


SPECIMEN J49
0
100
200
300
400
MATERIAL T
0
200
400
600
800
J-INTEGRAL, kN/m

```
     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

 SPECIMEN NUMBER                                       J49
 MATERIAL TYPE                                         A106B
 MATERIAL CONDITION                                    WELD(PN107)
 TEST TEMPERATURE(DEG C)                               250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             324
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           548.2
 CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
 SPECIMEN THICKNESS B(CM)                              1.637
 PERCENT SIDE GROOVE                                   20.403
 SPECIMEN WIDTH W(CM)                                  3.809
 YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
 EFFECTIVE MODULUS(Pa)                                 2.1491868E+11

                FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              19.36
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                   2.204

                CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                        2.279
 INITIAL A/W                                           .579
 AVERAGE CRACK EXTENSION 9PT(CM)                       .366
 DELTA A(CM) COMPLIANCE                                .375
 MAX DEVIATION OF SINGLE MEASUREMENT %                 2.49

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   11
 LAST POINT                    14
 JIC(KN/M)                     121
 CORRELATION COEFF             .99
 SLOPE M(MPa)                  79
 INTERCEPT B (KN/M)            110

                VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD      YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD         YES

                QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                              NO
 CRACK SIZE DA<0.15*DELTA A                            YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       284.12
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     268.1
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      1.605
 25*JQ/EF.Y.(CM)                                       .694

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      11
 LAST DATA POINT USED     19
 CONSTANT(C1)             194.36
 EXPONENT(C2)             .372
```

J49(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
18.9	1.78	.07	1.85	1.85	2.02	2.177	1
30.47	4.62	.05	4.67	4.67	4.94	2.203	2
41.04	8.39	.53	8.92	8.92	9.4	2.209	3
49.72	12.31	3.35	15.66	15.66	16.4	2.196	4
58.33	16.94	7.16	24.1	24.14	25.05	2.212	5
65.11	21.11	14.71	35.82	35.88	37	2.216	6
70.07	24.44	27.06	51.5	51.6	52.86	2.218	7
73.43	26.84	43.9	70.74	70.79	72.26	2.216	8
76.25	28.95	63.86	92.8	92.9	94.43	2.218	9
79.05	31.11	84.87	115.98	116.79	117.62	2.231	10
80.66	32.39	109.66	142.05	143.8	143.64	2.244	11
82.1	33.56	134.64	168.2	172.71	169.56	2.274	12
84.22	35.32	157.72	193.04	201.95	194.13	2.313	13
84.45	35.51	184.63	220.14	232.76	220.95	2.34	14
85.55	36.44	206.72	243.16	263.49	243.57	2.387	15
85.2	36.14	229.77	265.91	294.35	265.88	2.431	16
85.6	36.48	248.62	285.1	323.98	284.69	2.48	17
86.16	36.96	265.38	302.34	353.33	301.59	2.531	18
86.05	36.86	281.98	318.85	382.45	317.73	2.579	19

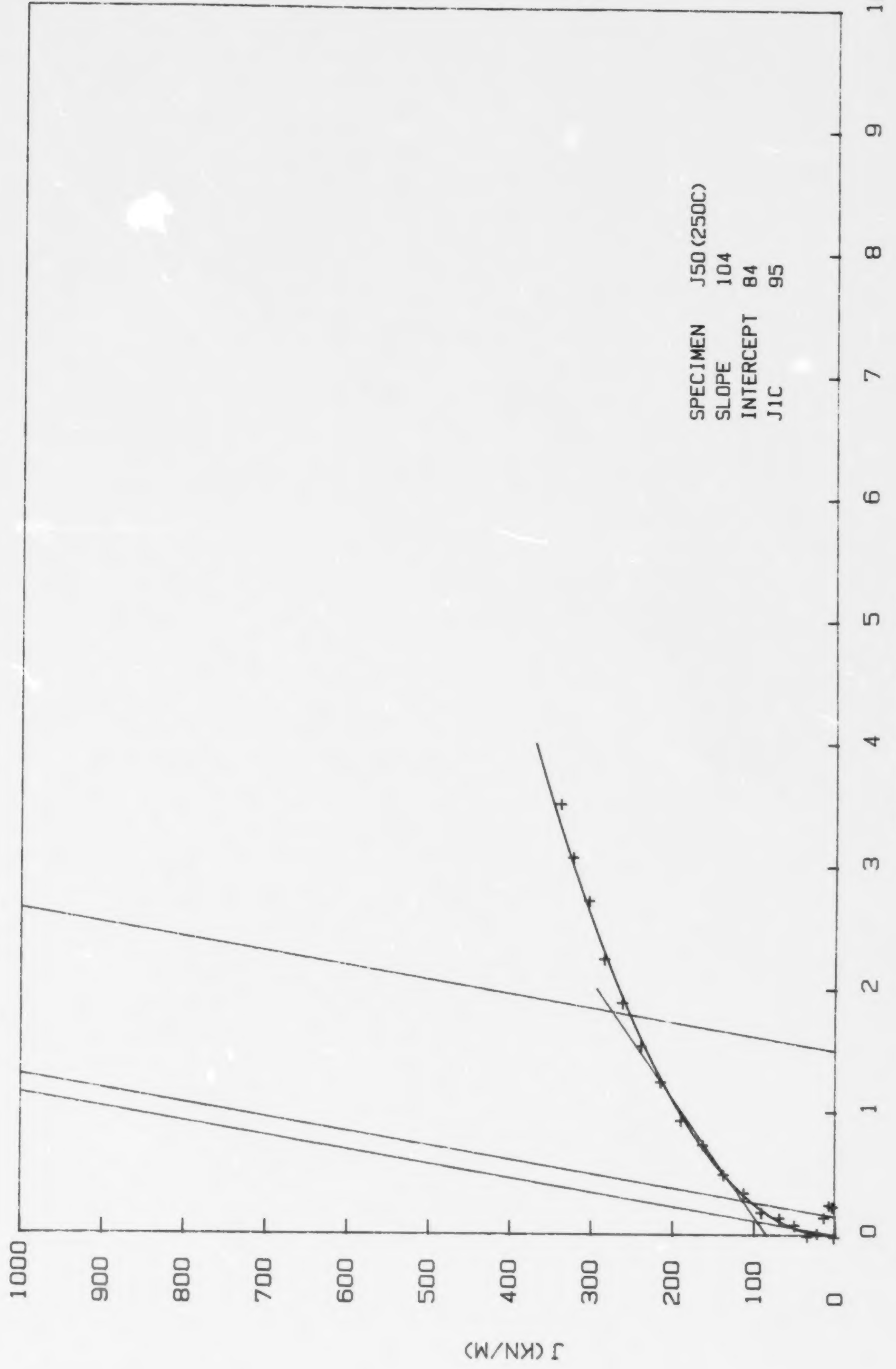
H(M)	D(M)	POISSON'S RATIO
.01428	2.54E-03	.3

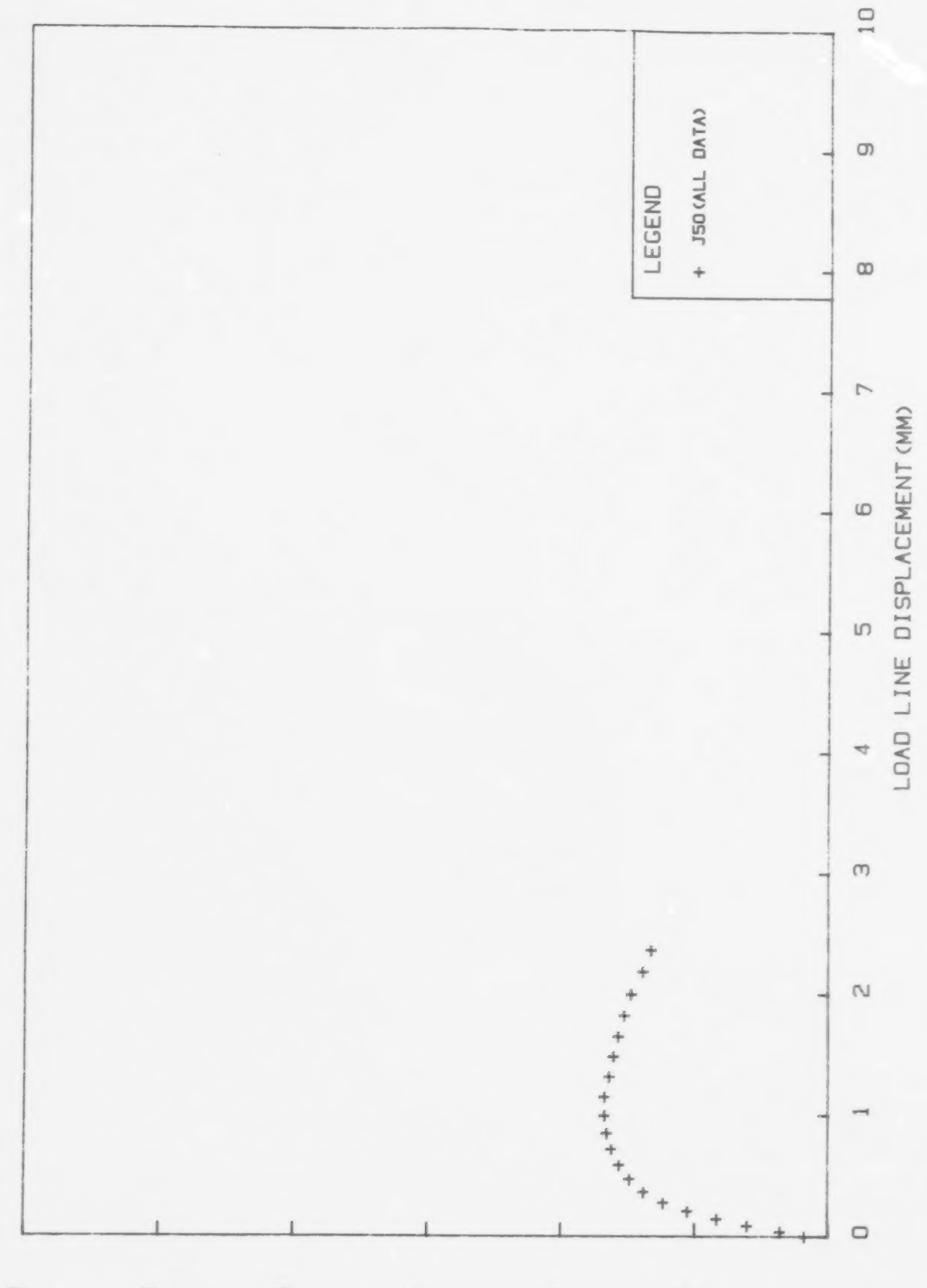
J49

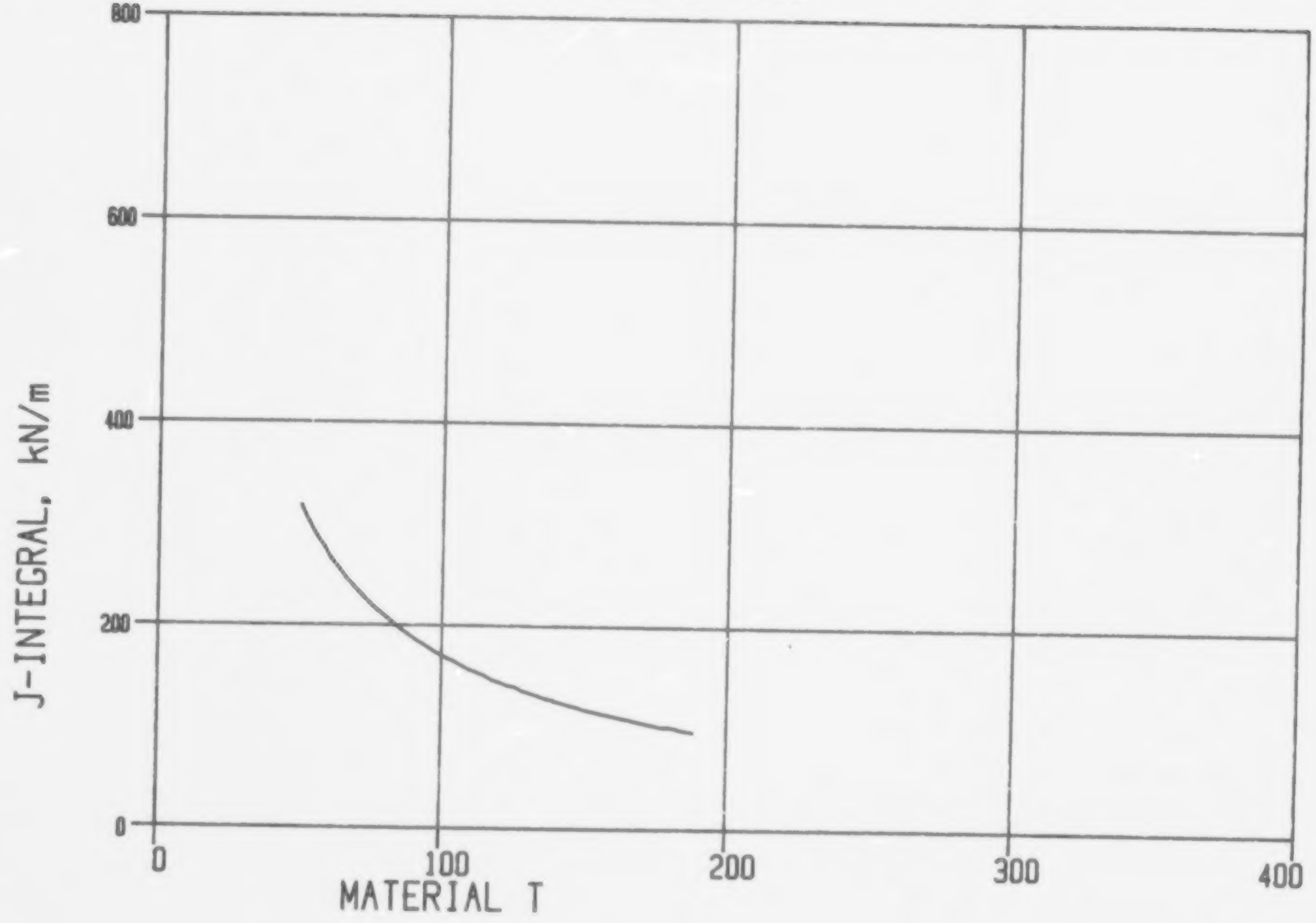
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.85	2.177	2.177	-.272	.9969	1
4.67	2.202	2.203	-.012	.9997	2
8.92	2.208	2.209	.045	.9993	3
15.66	2.194	2.196	-.084	.9997	4
24.1	2.21	2.212	.077	.9997	5
35.82	2.214	2.216	.119	.9999	6
51.5	2.215	2.218	.142	.9997	7
70.74	2.213	2.216	.122	.9998	8
92.8	2.213	2.218	.135	.9999	9
115.98	2.226	2.231	.271	.9998	10
142.05	2.238	2.244	.403	.9998	11
168.2	2.267	2.274	.704	.9997	12
193.04	2.305	2.313	1.087	.9994	13
220.14	2.331	2.34	1.358	.9996	14
243.16	2.378	2.387	1.833	.9999	15
265.91	2.421	2.431	2.268	.9998	16
285.1	2.469	2.48	2.759	.9998	17
302.34	2.52	2.531	3.27	.9998	18
318.85	2.568	2.579	3.754	.9998	19

```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J49
 1          2.393          0
 2          4.395          .04
 3          6.909          .092
 4          9.253          .144
 5          11.353         .206
 6          13.11          .276
 7          14.575         .358
 8          15.649         .457
 9          16.431         .569
 10         17.041         .693
 11         17.432         .826
 12         17.554         .973
 13         17.334         1.133
 14         17.09          1.296
 15         16.65          1.465
 16         16.016         1.642
 17         15.186         1.821
 18         14.404         2.001
 19         13.623         2.184
 20         12.793         2.369
```

	J(KN/M)	T	W	J49
1	129.01	189.48	23.91	
2	155.13	83.72	8.62	
3	180.62	62.21	5.36	
4	206.59	96.07	7.11	
5	231.65	46.58	2.97	
6	254.53	50.31	2.83	
7	275.5	37.57	1.89	
8	293.72	32.41	1.47	
9	310.59	32.74	1.35	


SPECIMEN J50(250C)
SLOPE 104
INTERCEPT 84
J1C 95
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J50 (ALL DATA)



SPECIMEN J50

```
      DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                      J50
  MATERIAL TYPE                                        A106B
  MATERIAL CONDITION                                   WELD(PN107)
  TEST TEMPERATURE(DEG C)                              250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            324
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          548.2
  CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
  SPECIMEN THICKNESS B(CM)                             1.637
  PERCENT SIDE GROOVE                                  19.303
  SPECIMEN WIDTH W(CM)                                 3.808
  YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
  EFFECTIVE MODULUS(Pa)                                2.08409303E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN                5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             20.04
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                  2.239

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                       2.317
  INITIAL A/W                                          .588
  AVERAGE CRACK EXTENSION 9PT(CM)                      .368
  DELTA A(CM) COMPLIANCE                               .351
  MAX DEVIATION OF SINGLE MEASUREMENT %                2

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                      10
  LAST POINT                       15
  JIC(KN/M)                        95
  CORRELATION COEFF                .99
  SLOPE M(MPa)                     104
  INTERCEPT B (KN/M)               84

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD         YES
  LIGAMENT>25JIC/EFFECTIVE YIELD YES
  DJ/DA<EFFECTIVE YIELD            YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                             NO
  CRACK SIZE DA<0.15*DELTA A                           YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      288.04
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    265.67
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.569
  25*JQ/EF.Y.(CM)                                      .545

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED        10
  LAST DATA POINT USED       20
  CONSTANT(C1)               191.95
  EXPONENT(C2)               .473
```

J50(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
16.39	1.34	.04	1.38	1.38	1.46	2.238	1
28.27	3.98	-.26	3.72	3.72	3.9	2.262	2
38.88	7.53	.28	7.8	7.81	8.19	2.264	3
48.49	11.71	2.45	14.16	14.15	14.81	2.253	4
56.21	15.73	6.98	22.71	22.68	23.63	2.241	5
62.72	19.58	15.28	34.86	34.82	36.01	2.238	6
68.09	23.08	27.52	50.6	50.67	51.89	2.247	7
72.08	25.86	43.28	69.14	69.35	70.55	2.253	8
75.01	28.01	63.31	91.32	91.7	92.81	2.257	9
77.94	30.24	82.46	112.7	113.91	114.19	2.273	10
79.95	31.82	105.77	137.59	139.84	139.03	2.288	11
81.98	33.46	129.38	162.84	167.28	164.12	2.312	12
81.89	33.39	156.78	190.17	196.84	191.21	2.332	13
83.05	34.34	180.9	215.24	226.2	216.01	2.363	14
83.82	34.98	204.45	239.43	255.12	239.94	2.392	15
84.77	35.78	226.61	262.38	284.56	262.59	2.427	16
85.39	36.3	248.6	284.9	314.53	284.78	2.463	17
85.03	36	267.7	303.69	344.5	303.15	2.511	18
84.94	35.92	287.58	323.5	373.48	322.63	2.546	19
85.2	36.14	302.8	338.94	401.34	337.78	2.59	20

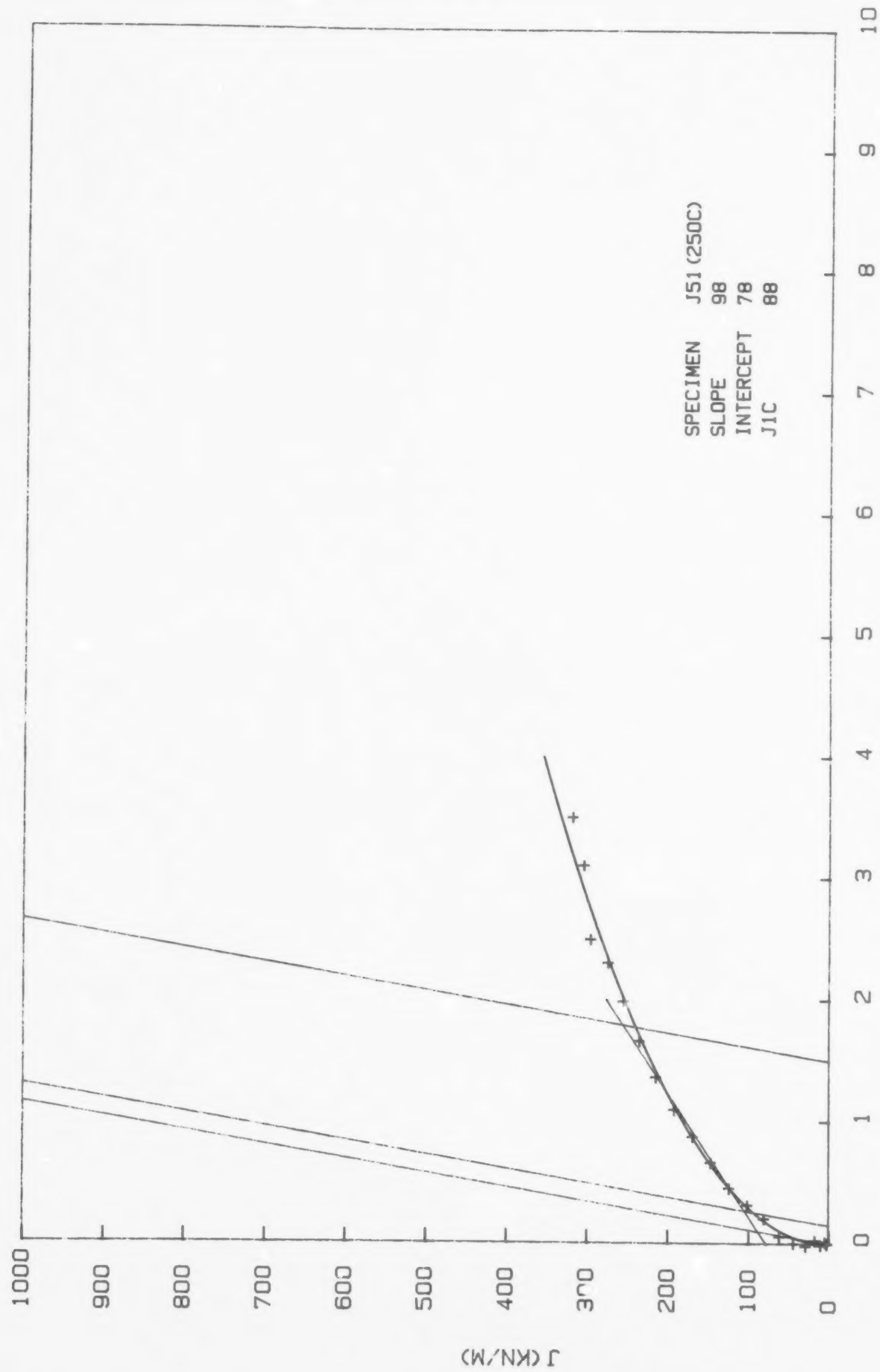
H(M)	D(M)	POISSON'S RATIO
.01429	2.54E-03	.3

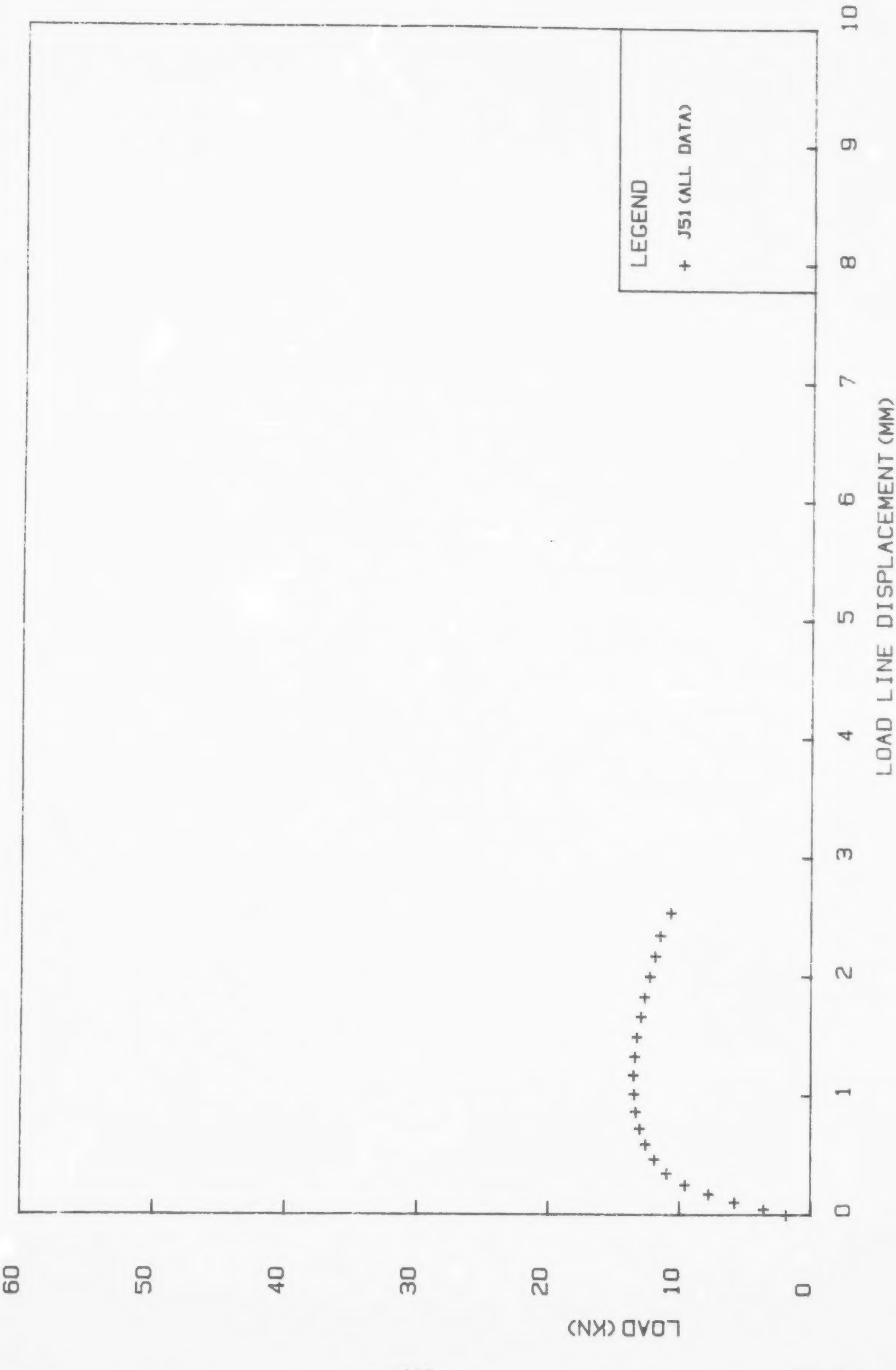
J50

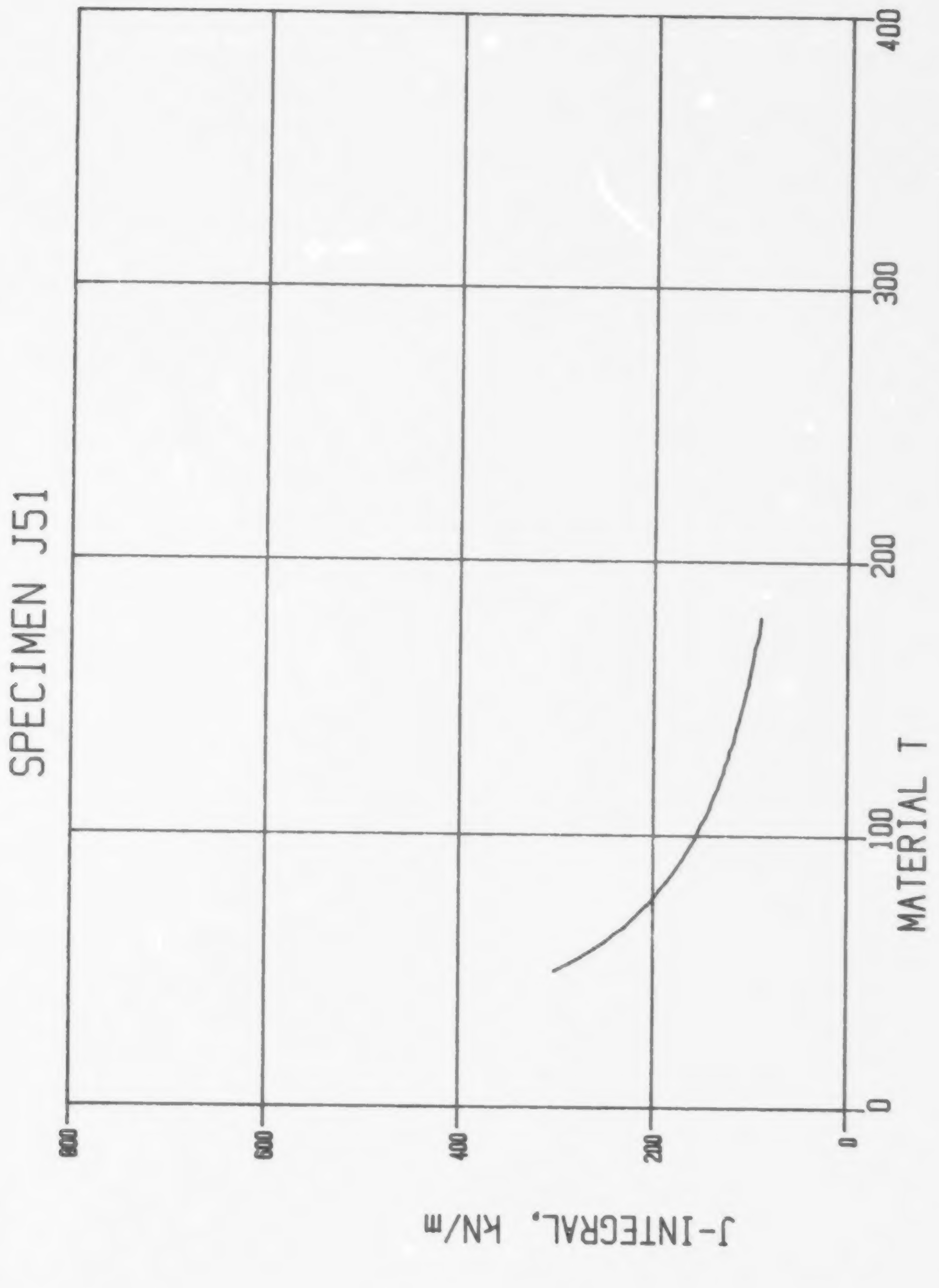
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.38	2.237	2.238	-.014	.999	1
3.72	2.262	2.262	.232	.9992	2
7.8	2.263	2.264	.246	.9996	3
14.16	2.252	2.253	.143	.9996	4
22.71	2.239	2.241	.016	.9994	5
34.86	2.236	2.238	-9E-03	.9997	6
50.6	2.244	2.247	.081	.9998	7
69.14	2.249	2.253	.138	.9999	8
91.32	2.253	2.257	.184	.9996	9
112.7	2.268	2.273	.341	.9997	10
137.59	2.282	2.288	.489	.9998	11
162.84	2.305	2.312	.73	.9995	12
190.17	2.324	2.332	.93	.9999	13
215.24	2.354	2.363	1.241	.9997	14
239.43	2.383	2.392	1.534	.9996	15
262.38	2.417	2.427	1.885	.9998	16
284.9	2.452	2.463	2.241	.9996	17
303.69	2.499	2.511	2.717	.9993	18
323.5	2.534	2.546	3.07	.9998	19
338.94	2.577	2.59	3.506	.9998	20

```
            LOAD(KN)        LOAD LINE DISPLACEMENT(MM)        J50
 1           1.733           0
 2           3.613           .04
 3           6.079           .089
 4           8.35            .144
 5           10.522          .208
 6           12.354          .277
 7           13.818          .365
 8           14.868          .471
 9           15.649          .587
 10          16.211          .719
 11          16.577          .848
 12          16.748          .995
 13          16.748          1.15
 14          16.382          1.315
 15          16.064          1.483
 16          15.698          1.649
 17          15.259          1.821
 18          14.746          1.998
 19          13.867          2.184
 20          13.257          2.363
 21          12.573          2.544
```

	J(KN/M)	T	W	J50
1	102.01	130.58	20.44	
2	125.15	161.71	20.44	
3	150.22	100.8	10.45	
4	176.5	131.69	11.46	
5	202.7	77.33	5.74	
6	227.34	79.36	5.14	
7	250.91	62.95	3.6	
8	273.64	60.76	3.11	
9	294.3	37.91	1.74	
10	313.6	53.89	2.26	
11	331.22	34.06	1.3	


SPECIMEN J51(250C)
SLOPE 98
INTERCEPT 78
J1C 88
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J51 (ALL DATA)
LOAD LINE DISPLACEMENT (MM)
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60


SPECIMEN J51
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J51
MATERIAL TYPE	A106B
MATERIAL CONDITION	HAZ(PN107)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	324
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	548.2
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	1.637
PERCENT SIDE GROOVE	18.57
SPECIMEN WIDTH W(CM)	3.804
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.00432193E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	23.81
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.4

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	2.449
INITIAL A/W	.631
AVERAGE CRACK EXTENSION 9PT(CM)	.357
DELTA A(CM) COMPLIANCE	.35
MAX DEVIATION OF SINGLE MEASUREMENT %	1.18

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	9
LAST POINT	15
JIC(KN/M)	88
CORRELATION COEFF	.99
SLOPE M(MPa)	98
INTERCEPT B (KN/M)	78

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	290.66
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	229.83
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.404
25*JQ/EF.Y.(CM)	.504

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	9
LAST DATA POINT USED	20
CONSTANT(C1)	181.63
EXPONENT(C2)	.4862

J51(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
19.31	1.86	.03	1.89	1.89	2.01	2.4	1
31.32	4.88	-.03	4.85	4.85	5.16	2.402	2
41.85	8.72	1.46	10.18	10.18	10.73	2.399	3
51.65	13.28	4.38	17.66	17.66	18.48	2.403	4
58.84	17.24	11.89	29.13	29.11	30.24	2.398	5
64.11	20.46	23.91	44.37	44.38	45.67	2.4	6
68.21	23.17	38.82	61.98	62.12	63.4	2.406	7
71.79	25.66	55.43	81.09	81.74	82.51	2.421	8
74.34	27.51	74.3	101.81	103.03	103.24	2.432	9
76.22	28.92	95.4	124.32	126.48	125.67	2.445	10
78.4	30.61	116.32	146.92	150.96	148.13	2.466	11
79.83	31.73	137.62	169.35	175.72	170.38	2.487	12
81.1	32.75	159.74	192.49	201.76	193.31	2.509	13
81.83	33.34	181.75	215.09	228.5	215.61	2.536	14
83.2	34.47	200.92	235.38	254.12	235.65	2.566	15
83.99	35.12	220.28	255.4	280.76	255.35	2.598	16
84.66	35.69	238.74	274.43	306.96	274.08	2.63	17
84.24	35.33	261.16	296.49	333.85	295.88	2.649	18
85.43	36.33	268.96	305.3	359.63	304.47	2.71	19
83.99	35.12	284.35	319.47	385.68	318.25	2.75	20

H(M)	D(M)	POISSON'S RATIO
.0143	2.54E-03	.3

J51

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.89	2.4	2.4	1E-03	.9995	1
4.85	2.401	2.402	.017	.9997	2
10.18	2.398	2.399	-.01	.9997	3
17.66	2.402	2.403	.029	.9998	4
29.13	2.396	2.398	-.018	.9991	5
44.37	2.398	2.4	3E-03	.9997	6
61.98	2.403	2.406	.059	.9993	7
81.09	2.417	2.421	.206	.9997	8
101.81	2.427	2.432	.317	.9997	9
124.32	2.44	2.445	.453	.9998	10
146.92	2.46	2.466	.663	.9999	11
169.35	2.481	2.487	.875	.9996	12
192.49	2.502	2.509	1.095	.9999	13
215.09	2.528	2.536	1.362	.9998	14
235.38	2.557	2.566	1.658	.9998	15
255.4	2.589	2.598	1.985	.9998	16
274.43	2.62	2.63	2.301	.9999	17
296.49	2.639	2.649	2.493	.9998	18
305.3	2.7	2.71	3.103	.9999	19
319.47	2.739	2.75	3.5	.9999	20

```
           LOAD(KN)     LOAD LINE DISPLACEMENT(MM)     J51
 1          1.831        0
 2          3.589        .048
 3          5.811        .105
 4          7.788        .175
 5          9.57         .251
 6          10.962       .348
 7          11.914       .464
 8          12.598       .59
 9          13.037       .724
 10         13.33        .863
 11         13.452       1.013
 12         13.501       1.169
 13         13.403       1.326
 14         13.257       1.489
 15         12.939       1.659
 16         12.671       1.824
 17         12.256       1.997
 18         11.841       2.169
 19         11.475       2.343
 20         10.669       2.534
 21         9.888        2.722
```

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        J(KN/M)                 T            W       J51

1          91.45       180.34          28.16
2          113.07      158.17          19.78
3          135.62      103.56          10.63
4          158.14      101.85          8.82
5          180.92      101.07          7.52
6          203.79      81.38           5.27
7          225.23      65.88           3.77
8          245.39      58.8            3.01
9          264.92      57.86           2.67
10         285.46      110.22          4.64
11         300.89      13.87           .52
12         312.38      34.35           1.21
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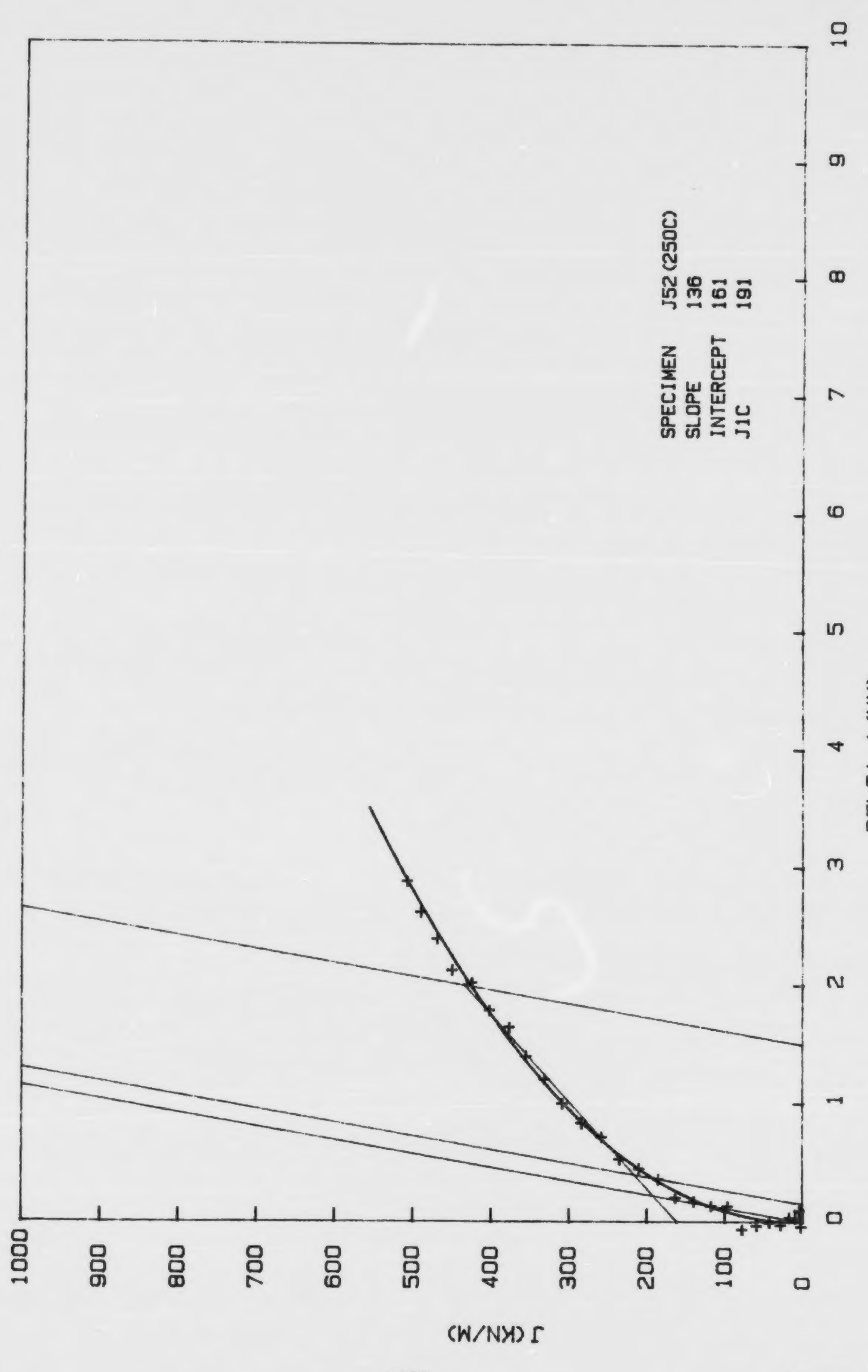
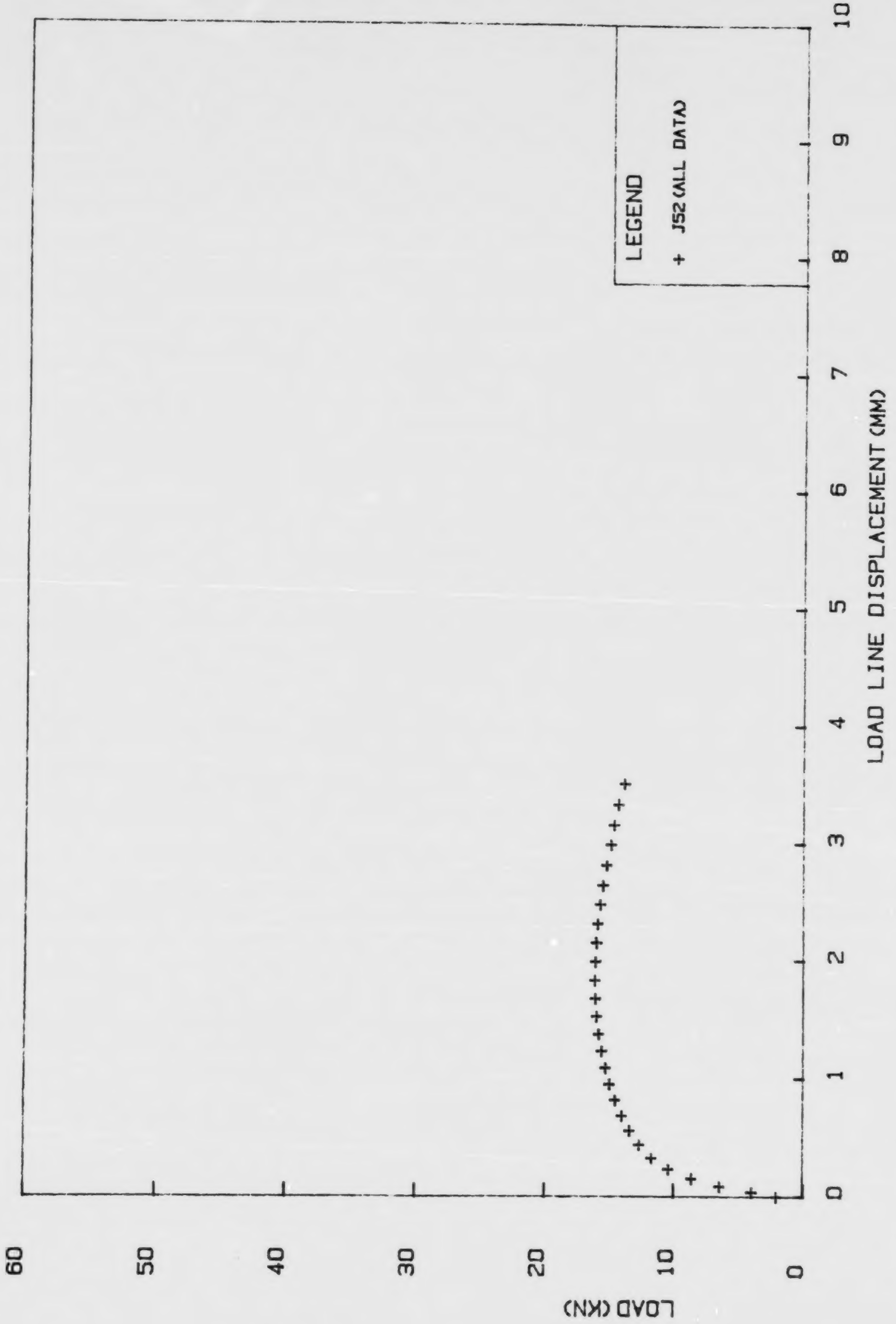
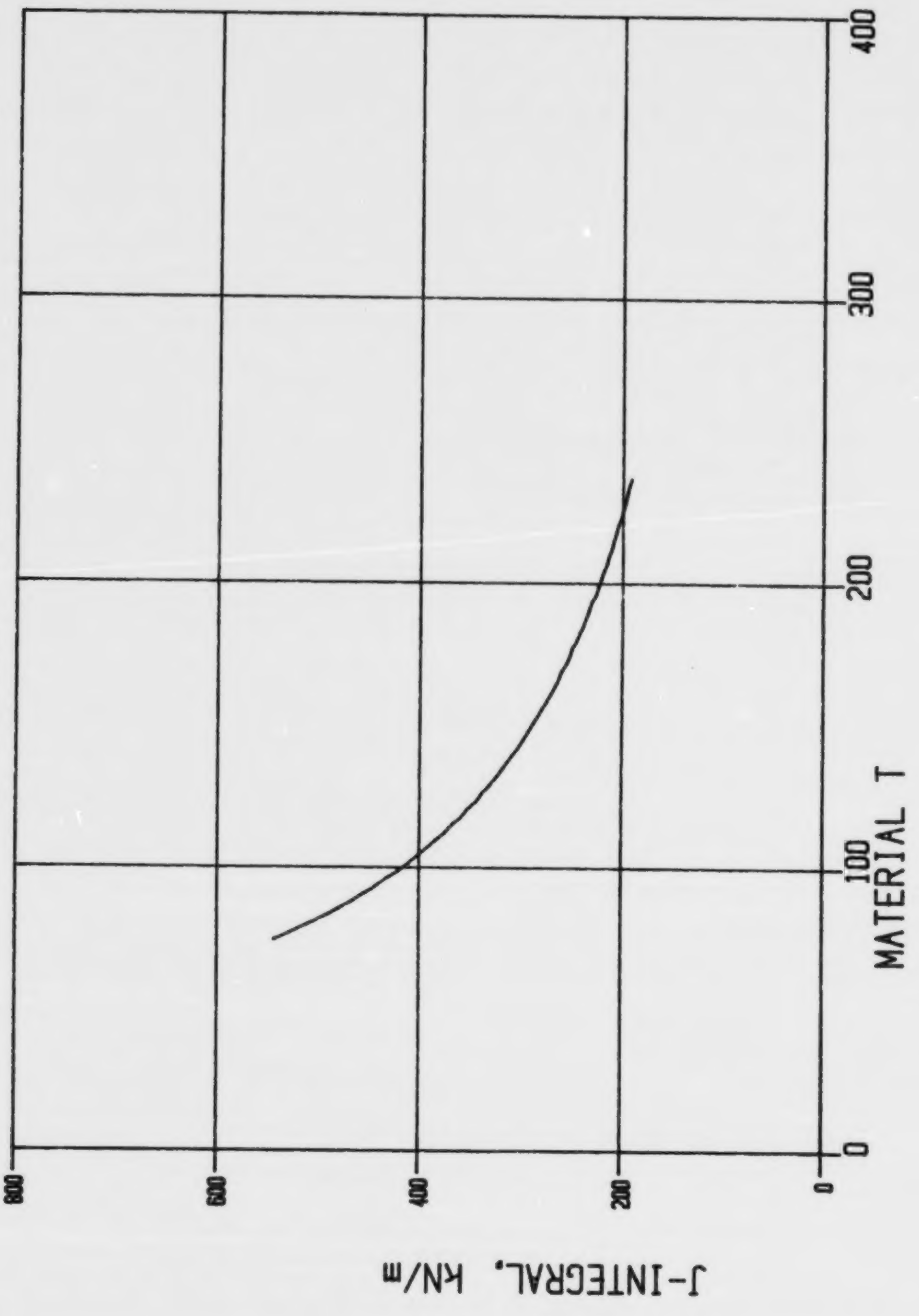

SPECIMEN J52 (250C)
SLOPE 136
INTERCEPT 161
J1C 191
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J52 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10

SPECIMEN J52



DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J52
MATERIAL TYPE	A106B
MATERIAL CONDITION	HAZ(PN107)
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	324
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	548.2
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	1.637
PERCENT SIDE GROOVE	18.875
SPECIMEN WIDTH W(CM)	3.813
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.02144345E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	20.19
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.25

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	2.306
INITIAL A/W	.59
AVERAGE CRACK EXTENSION 9PT(CM)	.311
DELTA A(CM) COMPLIANCE	.288
MAX DEVIATION OF SINGLE MEASUREMENT %	1.49

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	14
LAST POINT	22
JIC(KN/M)	191
CORRELATION COEFF	.99
SLOPE M(MPa)	136
INTERCEPT B (KN/M)	161

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	289.57
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	278.12
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.563
25*JQ/EF.Y.(CM)	1.095

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	14
LAST DATA POINT USED	27
CONSTANT(C1)	307.03
EXPONENT(C2)	.4739

J52(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
18.1	1.63	.01	1.64	1.64	1.74	2.246	1
29.82	4.43	-.25	4.18	4.18	4.4	2.26	2
39.47	7.76	1.51	9.26	9.26	9.69	2.253	3
47.66	11.31	5.82	17.13	17.13	17.75	2.254	4
53.37	14.18	14.02	28.2	28.17	29.01	2.248	5
57.83	16.65	26.1	42.75	42.75	43.68	2.25	6
61.11	18.59	40.83	59.42	59.35	60.47	2.247	7
63.68	20.19	57.72	77.91	77.73	79.08	2.244	8
67.31	22.56	73.79	96.34	97.11	97.49	2.263	9
69.36	23.95	93.81	117.76	118.54	118.98	2.264	10
71.11	25.18	114.74	139.92	141.01	141.17	2.268	11
72.69	26.3	136.96	163.26	164.64	164.55	2.27	12
74.91	27.94	157.27	185.21	188.42	186.45	2.286	13
76.42	29.07	180.56	209.63	214.04	210.84	2.295	14
77.52	29.92	204.93	234.85	240.49	236.03	2.303	15
79.27	31.29	226.53	257.81	266.72	258.9	2.322	16
80.03	31.89	251.73	283.62	294.86	284.62	2.333	17
81.09	32.74	275.45	308.19	323.07	309.07	2.35	18
82.43	33.83	297.43	331.26	351.19	332	2.371	19
83.16	34.43	320.68	355.12	380.15	355.7	2.39	20
84.38	35.45	341.34	376.79	408.81	377.22	2.414	21
84.17	35.27	367.03	402.3	438.88	402.56	2.429	22
84.5	35.55	389.27	424.82	469.2	424.86	2.452	23
84.31	35.39	414.69	450.08	498.36	449.99	2.463	24
84.95	35.93	433.09	469.02	527.54	468.75	2.489	25
84.33	35.41	454.64	490.05	557.9	489.53	2.511	26
85.1	36.05	471.32	507.38	586.72	506.7	2.538	27

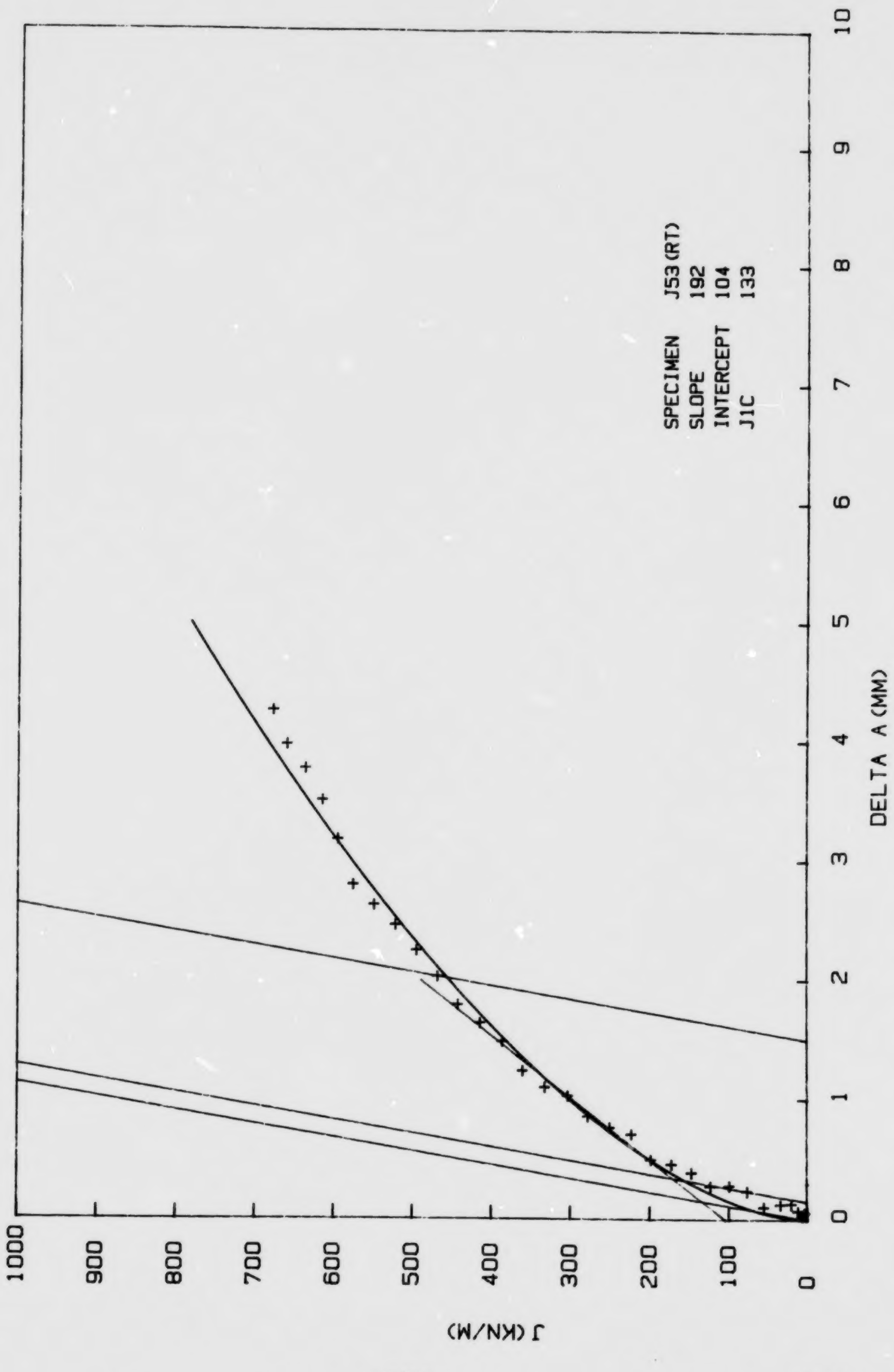
H(M)	D(M)	POISSON'S RATIO
.01426	2.54E-03	.3

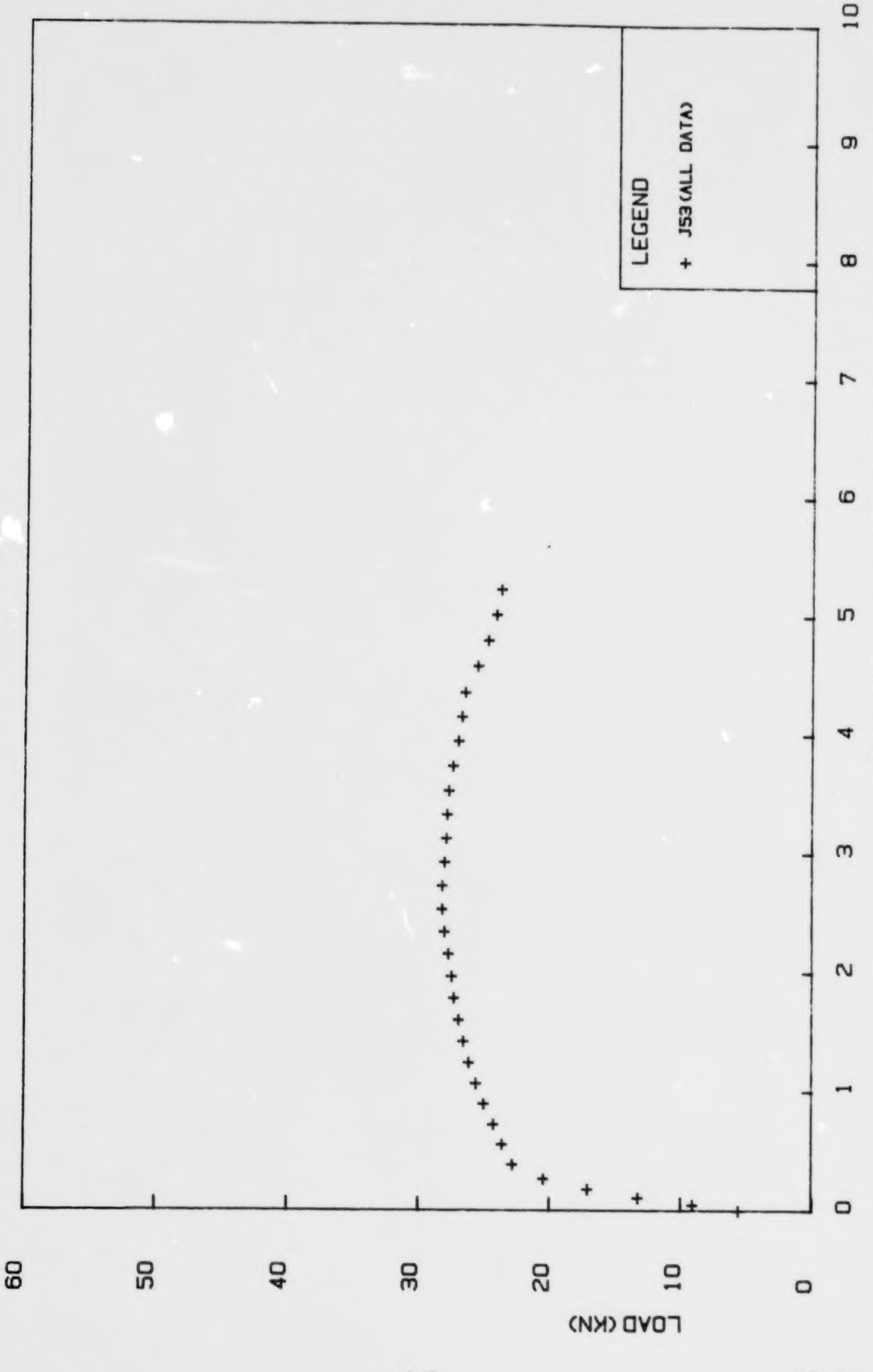
J52

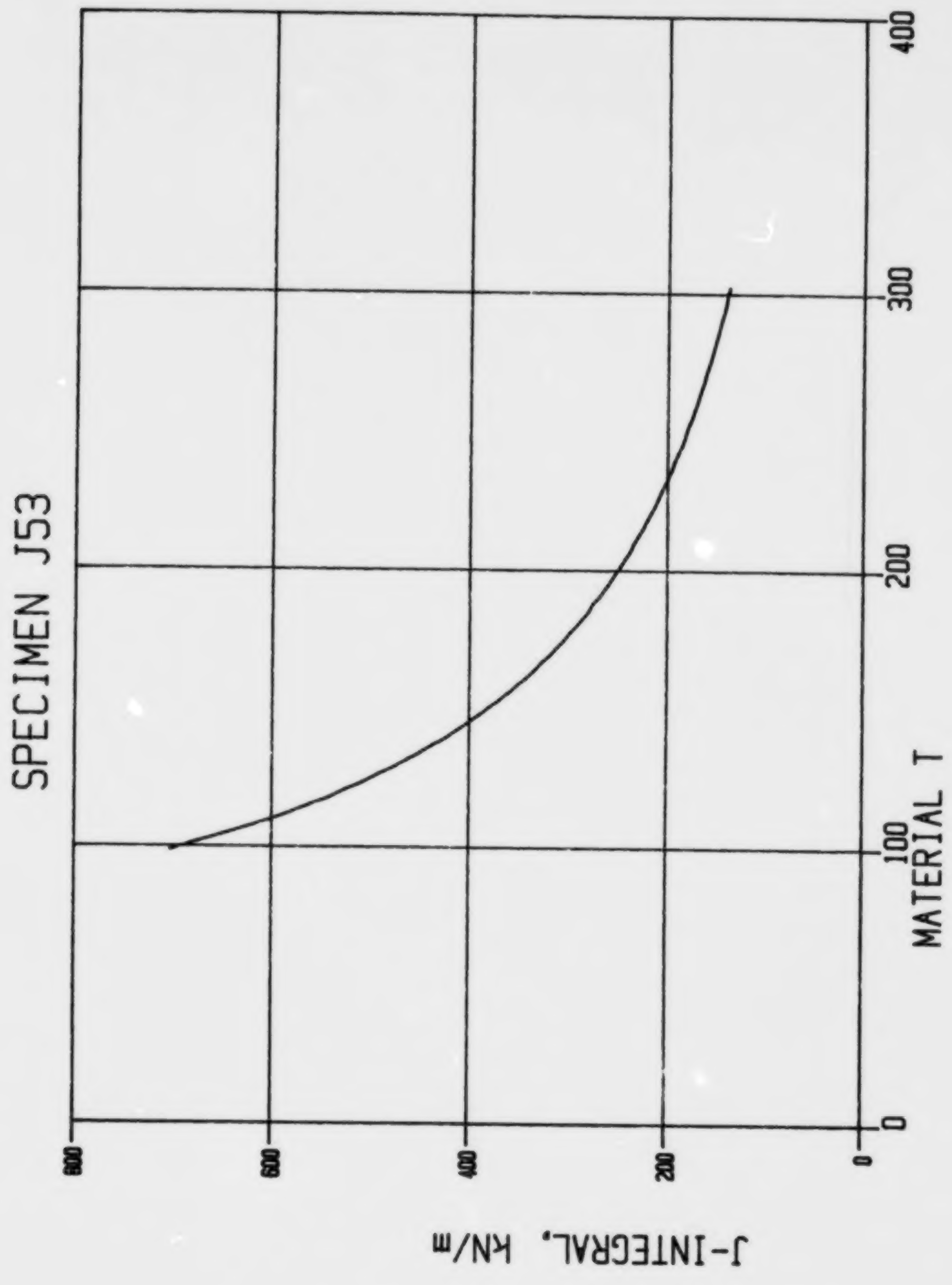
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.64	2.246	2.246	-.037	.9989	1
4.18	2.259	2.26	.097	.9996	2
9.26	2.253	2.253	.035	.9994	3
17.13	2.253	2.254	.04	.9997	4
28.2	2.246	2.248	-.021	.9996	5
42.75	2.247	2.25	0	.9998	6
59.42	2.244	2.247	-.029	.9997	7
77.91	2.24	2.244	-.061	.9997	8
96.34	2.258	2.263	.134	.9998	9
117.76	2.258	2.264	.136	.9998	10
139.92	2.261	2.268	.176	.9995	11
163.26	2.263	2.27	.205	.9992	12
185.21	2.278	2.286	.362	.9998	13
209.63	2.286	2.295	.452	.9998	14
234.85	2.293	2.303	.531	.9998	15
257.81	2.31	2.322	.716	.9999	16
283.62	2.321	2.333	.834	.9995	17
308.19	2.337	2.35	1	.9997	18
331.26	2.357	2.371	1.208	.9996	19
355.12	2.375	2.39	1.4	.9996	20
376.79	2.399	2.414	1.641	.9998	21
402.3	2.413	2.429	1.787	.9997	22
424.82	2.435	2.452	2.018	.9998	23
450.08	2.445	2.463	2.125	.9994	24
469.02	2.47	2.489	2.388	.9998	25
490.05	2.492	2.511	2.614	.9998	26
507.38	2.518	2.538	2.875	.9993	27

```
          LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J52
 1         2.026          0
 2         3.979          .04
 3         6.47           .089
 4         8.618          .154
 5        10.4            .233
 6        11.719          .327
 7        12.671          .441
 8        13.428          .56
 9        14.038          .686
 10       14.551          .818
 11       14.99           .953
 12       15.308         1.093
 13       15.601         1.235
 14       15.82          1.379
 15       15.991         1.53
 16       16.089         1.682
 17       16.138         1.835
 18       16.089         1.995
 19       16.016         2.156
 20       15.918         2.317
 21       15.723         2.482
 22       15.527         2.646
 23       15.234         2.816
 24       14.893         2.992
 25       14.673         3.158
 26       14.331         3.331
 27       13.843         3.512
 28       13.525         3.688
```

	J(KN/M)	T	W	J52
1	197.42	262.38	20.99	
2	222.24	304.43	21.52	
3	246.33	119.56	7.53	
4	270.72	209.59	11.92	
5	295.91	142.5	7.33	
6	319.72	106.76	5.01	
7	343.19	119.28	5.15	
8	365.95	86.36	3.44	
9	389.55	167.79	6.2	
10	413.56	93.81	3.21	
11	437.45	226.31	7.27	
12	459.55	69.27	2.08	
13	479.53	89.49	2.53	
14	498.71	63.75	1.7	


SPECIMEN J53 (RT)
SLOPE 192
INTERCEPT 104
J1C 133
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J53 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J53
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J53
MATERIAL TYPE	A105 FORGING
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	322.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	560.6
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	21.062
SPECIMEN WIDTH W(CM)	5.079
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.16700963E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	23.41
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.047

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.146
INITIAL A/W	.6
AVERAGE CRACK EXTENSION 9PT(CM)	.42
DELTA A(CM) COMPLIANCE	.426
MAX DEVIATION OF SINGLE MEASUREMENT %	.65

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	12
LAST POINT	21
JIC(KN/M)	133
CORRELATION COEFF	.98
SLOPE M(MPa)	192
INTERCEPT B (KN/M)	104

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	442.75
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	354.59
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.032
25*JQ/EF.Y.(CM)	.753

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	12
LAST DATA POINT USED	31
CONSTANT(C1)	301.1
EXPONENT(C2)	.5934

J53(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. (CM)	LN
24.52	2.85	.02	2.87	2.87	3.04	3.053	1
35.64	6.01	.21	6.22	6.22	6.61	3.05	2
46.14	10.07	1.68	11.75	11.75	12.41	3.055	3
55.45	14.55	5.81	20.36	20.37	21.3	3.06	4
61.89	18.12	16.13	34.24	34.25	35.43	3.06	5
63.92	19.33	36.23	55.56	55.54	56.85	3.058	6
66.42	20.87	55.99	76.87	77.16	78.16	3.071	7
68.66	22.3	77.3	99.61	100.06	100.96	3.075	8
70.31	23.39	99.95	123.34	123.77	124.77	3.075	9
72.46	24.84	122.39	147.23	148.4	148.67	3.086	10
74.05	25.95	146.43	172.38	174.1	173.83	3.093	11
75.31	26.83	171.81	198.64	200.74	200.12	3.097	12
77.63	28.51	194.62	223.13	227.6	224.55	3.118	13
78.5	29.15	221.19	250.34	255.53	251.76	3.124	14
79.79	30.12	247.71	277.82	284.36	279.22	3.133	15
81.79	31.65	271.93	303.58	312.93	304.94	3.15	16
82.81	32.45	300.03	332.47	343.13	333.82	3.157	17
83.75	33.18	327.5	360.69	374.09	361.95	3.171	18
84.93	34.13	352.54	386.67	405.51	387.78	3.196	19
85.67	34.72	380.22	414.94	437.49	415.95	3.211	20
86.61	35.49	407.55	443.04	469.58	443.95	3.227	21
87.98	36.62	432.08	468.71	501.84	469.49	3.25	22
88.69	37.21	458.2	495.41	535.11	496.03	3.272	23
88.97	37.45	484.71	522.16	568.73	522.59	3.293	24
89.48	37.88	511.5	549.38	601.67	549.69	3.31	25
90.04	38.36	537.67	576.03	634.57	576.21	3.327	26
89.8	38.15	557.36	595.51	668.73	595.42	3.365	27
89.75	38.11	577.04	615.15	701.84	614.83	3.398	28
89.78	38.13	598.7	636.83	734.9	636.31	3.424	29
90.17	38.47	621.62	660.08	767.29	659.42	3.444	30
91.1	39.26	638.53	677.79	798.63	677.01	3.473	31

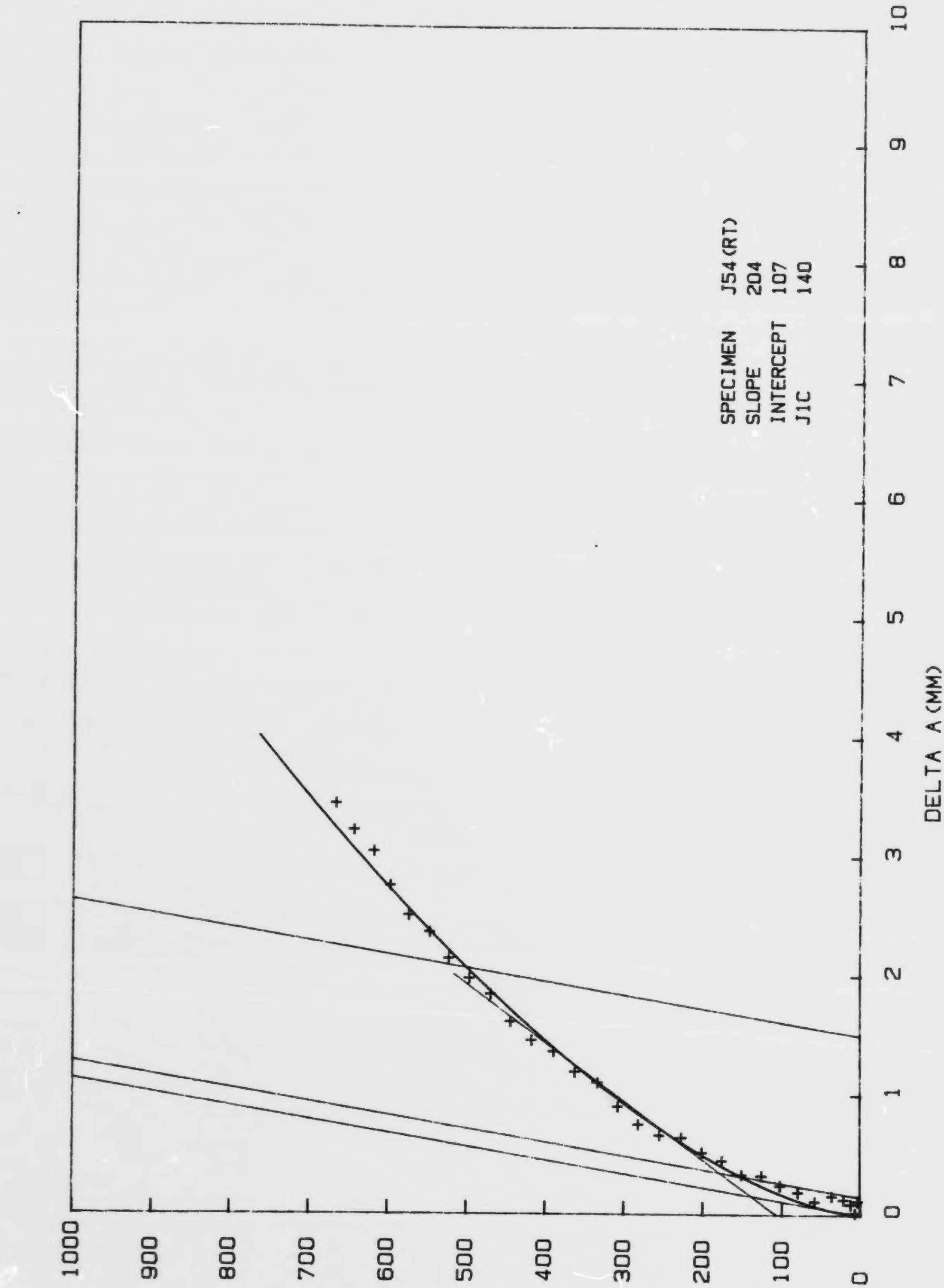
H(M)	D(M)	POISSON´S RATIO
.01904	2.54E-03	.3

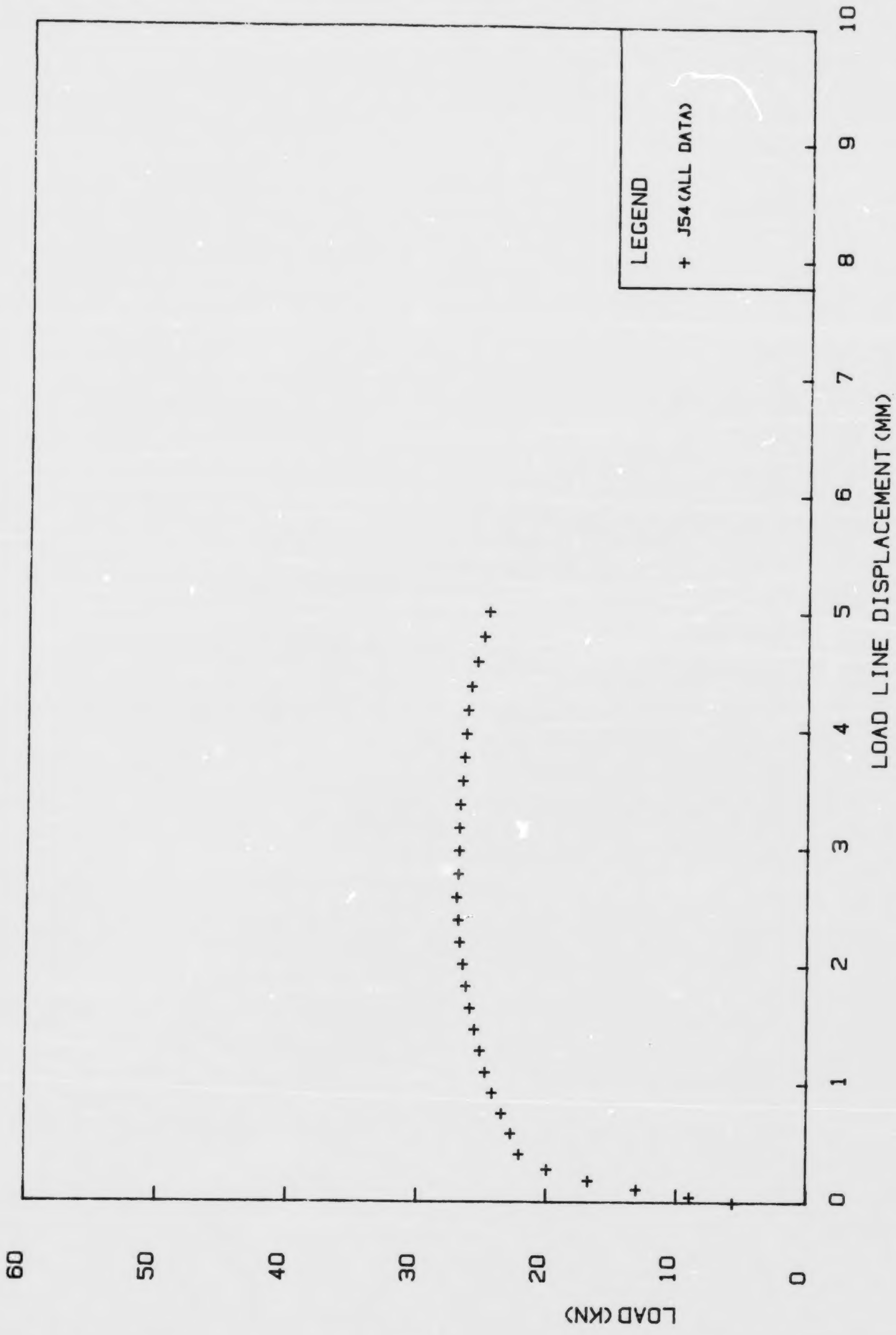
J53

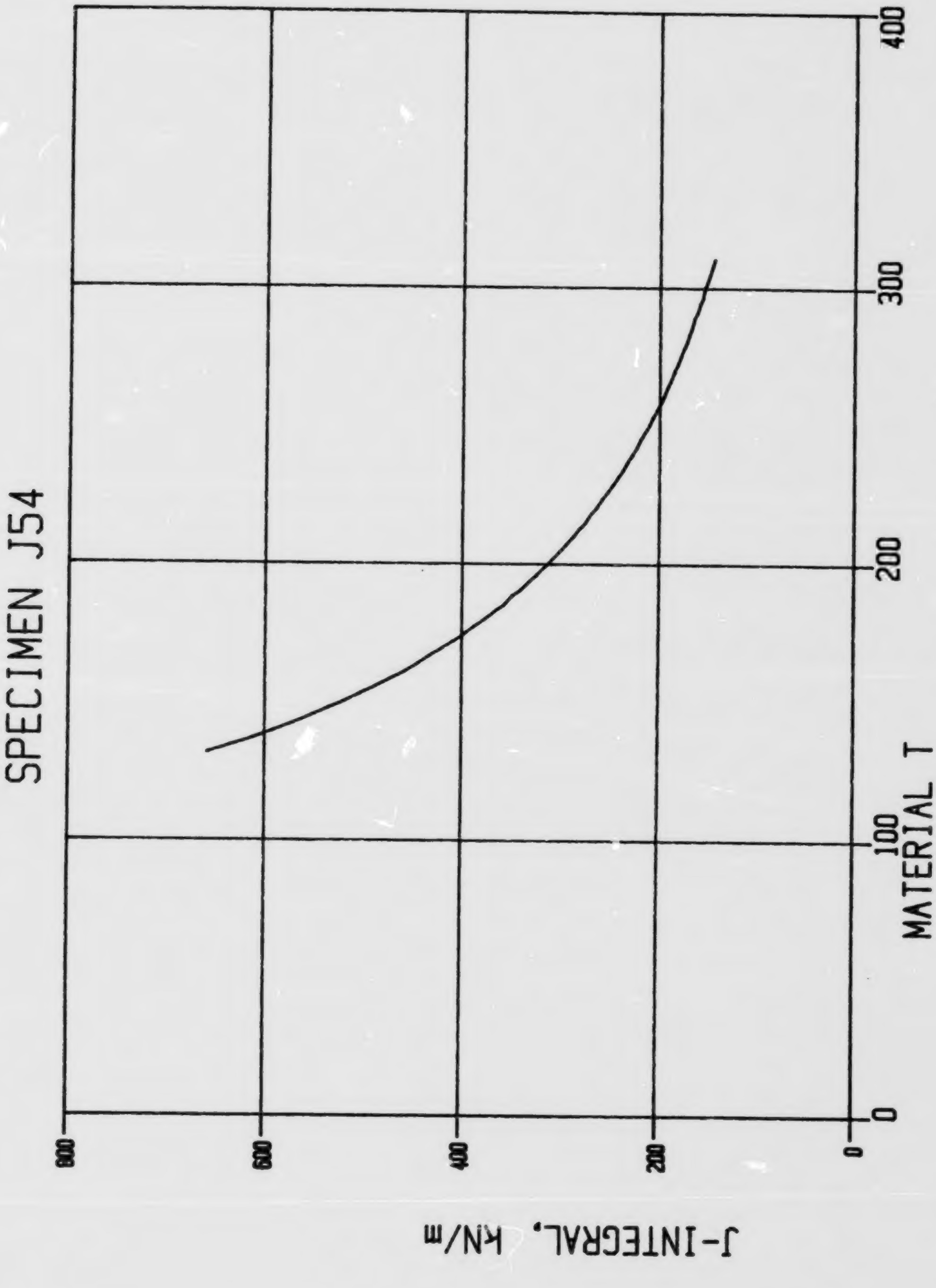
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.87	3.053	3.053	.061	.9999	1
6.22	3.05	3.05	.034	.9999	2
11.75	3.054	3.055	.076	1	3
20.36	3.059	3.06	.134	.9999	4
34.24	3.058	3.06	.13	1	5
55.56	3.055	3.058	.107	.9999	6
76.87	3.067	3.071	.24	.9998	7
99.61	3.07	3.075	.284	.9998	8
123.34	3.069	3.075	.279	.9999	9
147.23	3.079	3.086	.393	.9999	10
172.38	3.085	3.093	.463	.9999	11
198.64	3.088	3.097	.502	.9998	12
223.13	3.108	3.118	.714	.9999	13
250.34	3.113	3.124	.769	.9998	14
277.82	3.121	3.133	.862	.9999	15
303.58	3.137	3.15	1.033	.9998	16
332.47	3.143	3.157	1.105	.9998	17
360.69	3.156	3.171	1.241	.9999	18
386.67	3.179	3.196	1.488	.9999	19
414.94	3.194	3.211	1.642	.9998	20
443.04	3.208	3.227	1.795	.9999	21
468.71	3.231	3.25	2.03	.9999	22
495.41	3.252	3.272	2.248	.9998	23
522.16	3.272	3.293	2.462	.9998	24
549.38	3.288	3.31	2.628	.9997	25
576.03	3.304	3.327	2.799	.9998	26
595.51	3.341	3.365	3.178	.9998	27
615.15	3.373	3.398	3.508	.9998	28
636.83	3.399	3.424	3.772	.9998	29
660.08	3.419	3.444	3.975	.9997	30
677.79	3.447	3.473	4.263	.9997	31

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J53
1	5.554	0	
2	9.094	.049	
3	13.245	.107	
4	17.09	.178	
5	20.447	.266	
6	22.827	.386	
7	23.621	.554	
8	24.292	.723	
9	25.024	.894	
10	25.635	1.064	
11	26.184	1.24	
12	26.611	1.418	
13	26.978	1.599	
14	27.344	1.782	
15	27.527	1.965	
16	27.771	2.153	
17	28.076	2.339	
18	28.259	2.529	
19	28.259	2.725	
20	28.076	2.925	
21	27.954	3.125	
22	27.893	3.325	
23	27.771	3.528	
24	27.466	3.735	
25	27.039	3.945	
26	26.794	4.15	
27	26.55	4.355	
28	25.574	4.578	
29	24.78	4.795	
30	24.17	5.012	
31	23.804	5.225	
32	23.376	5.435	

	J(KN/M)	T	W	J53
1	135.29	208.12	31.09	
2	159.81	351.94	44.35	
3	185.51	664.49	71.99	
4	210.88	114.14	10.76	
5	236.74	484	40.53	
6	264.08	292.64	21.87	
7	290.7	148.39	9.98	
8	318.02	396.5	24.29	
9	346.58	203.68	11.37	
10	373.68	103.96	5.31	
11	400.81	180.79	8.54	
12	428.99	180.34	7.9	
13	455.87	107.95	4.39	
14	482.06	120.65	4.59	
15	508.78	123.64	4.4	
16	535.77	161.43	5.41	
17	562.7	153.85	4.86	
18	585.77	50.66	1.5	
19	605.33	58.73	1.65	
20	625.99	80.71	2.16	
21	648.46	113.29	2.9	
22	668.94	60.67	1.48	


SPECIMEN J54(RT)
SLOPE 204
INTERCEPT 107
J1C 140
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ JS4 (ALL DATA)


SPECIMEN J54
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
   DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J54
 MATERIAL TYPE                                        A105 FORGING
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            322.7
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          560.6
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             2.54
 PERCENT SIDE GROOVE                                  21.614
 SPECIMEN WIDTH W(CM)                                 5.083
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.1668476E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             24.15
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.09

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.193
 INITIAL A/W                                          .608
 AVERAGE CRACK EXTENSION 9PT(CM)                      .358
 DELTA A(CM) COMPLIANCE                               .344
 MAX DEVIATION OF SINGLE MEASUREMENT %                .83

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    11
 LAST POINT                     23
 JIC(KN/M)                      140
 CORRELATION COEFF              .98
 SLOPE M(MPa)                   204
 INTERCEPT B (KN/M)             107

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             YES
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      439.66
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    364.12
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.993
 25*JQ/EF.Y.(CM)                                      .792

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       11
 LAST DATA POINT USED      30
 CONSTANT(C1)              316.07
 EXPONENT(C2)              .6381
```

J54(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
25.17	3	.02	3.02	3.02	3.19	3.102	1
36.35	6.25	.31	6.57	6.57	7	3.092	2
46.99	10.45	1.85	12.3	12.3	13.01	3.099	3
56.04	14.86	6.58	21.44	21.45	22.47	3.103	4
62.19	18.3	18.05	36.35	36.36	37.6	3.106	5
63.84	19.28	39.21	58.49	58.45	59.85	3.101	6
66.31	20.8	58.98	79.78	79.95	81.2	3.109	7
68.66	22.31	79.91	102.21	102.58	103.69	3.115	8
70.68	23.64	102.07	125.7	126.5	127.21	3.123	9
71.94	24.49	126.56	151.04	151.89	152.61	3.124	10
73.86	25.81	149.77	175.58	177.41	177.13	3.135	11
75.33	26.85	174.25	201.1	203.61	202.67	3.142	12
76.98	28.03	198.84	226.88	230.8	228.43	3.154	13
77.81	28.64	226.33	254.97	259.14	256.55	3.156	14
79.13	29.63	251.91	281.54	287.14	283.1	3.166	15
80.47	30.64	276.92	307.55	315.65	309.06	3.18	16
82.2	31.97	301.24	333.2	345.05	334.62	3.2	17
82.44	32.15	330.15	362.3	375.96	363.64	3.209	18
83.44	32.94	356.53	389.47	406.95	390.7	3.226	19
84.12	33.48	383.98	417.46	437.27	418.64	3.236	20
85.06	34.23	410.08	444.3	468.23	445.39	3.251	21
86.19	35.15	434.08	469.23	499.75	470.18	3.274	22
86.8	35.65	460.89	496.53	531.08	497.39	3.288	23
87.7	36.39	486.29	522.68	562.69	523.43	3.304	24
89.03	37.5	509.43	546.94	594.56	547.59	3.326	25
89.33	37.75	536.08	573.83	626.57	574.37	3.34	26
89.69	38.06	559.32	597.38	659.81	597.72	3.365	27
90.37	38.63	579.79	618.43	692.61	618.59	3.394	28
90.58	38.82	605.15	643.96	725.9	643.97	3.412	29
90.91	39.1	627.75	666.86	758.76	666.7	3.434	30

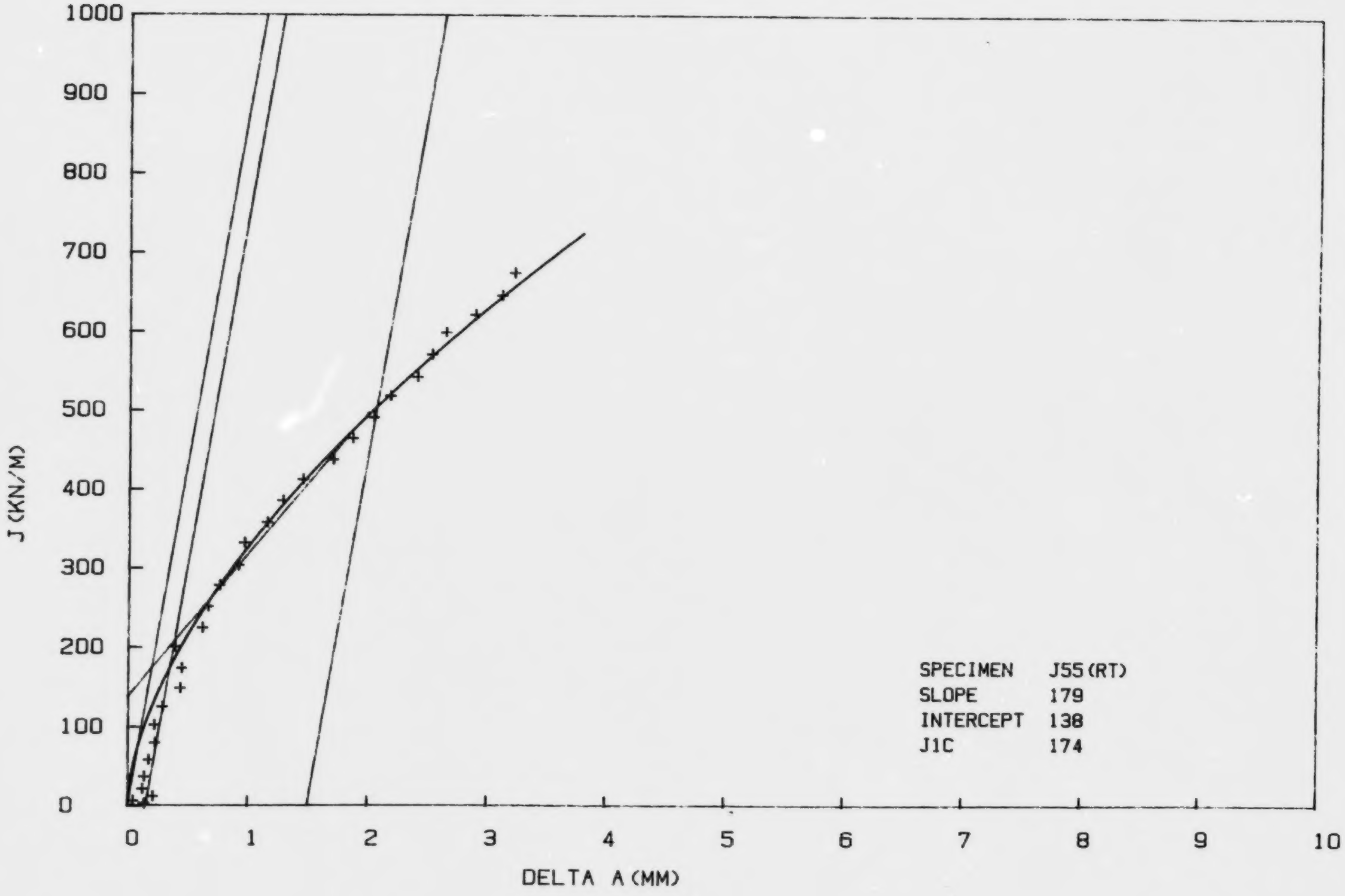
H(M)	D(M)	POISSON'S RATIO
.01901	2.54E-03	.3

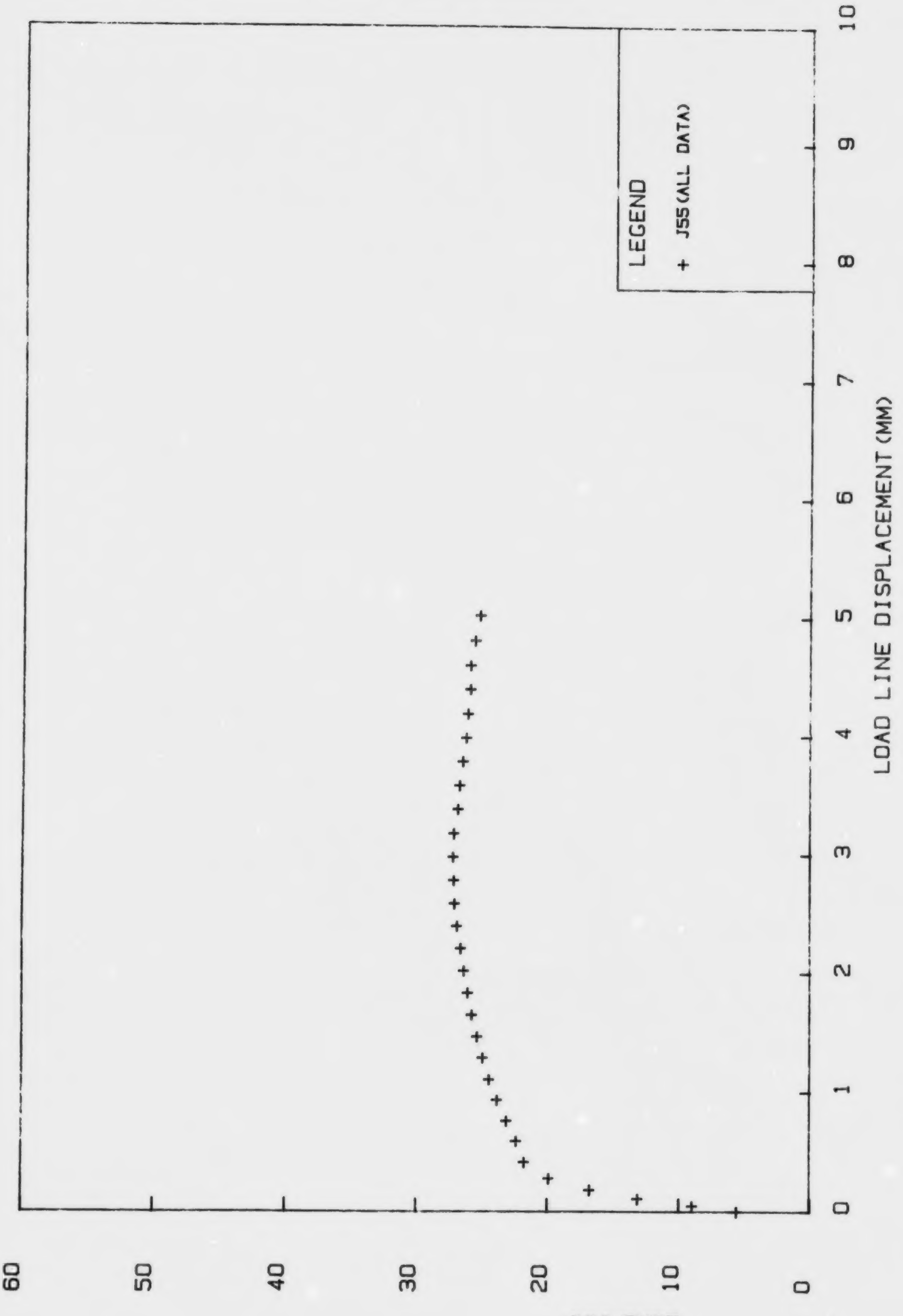
J54

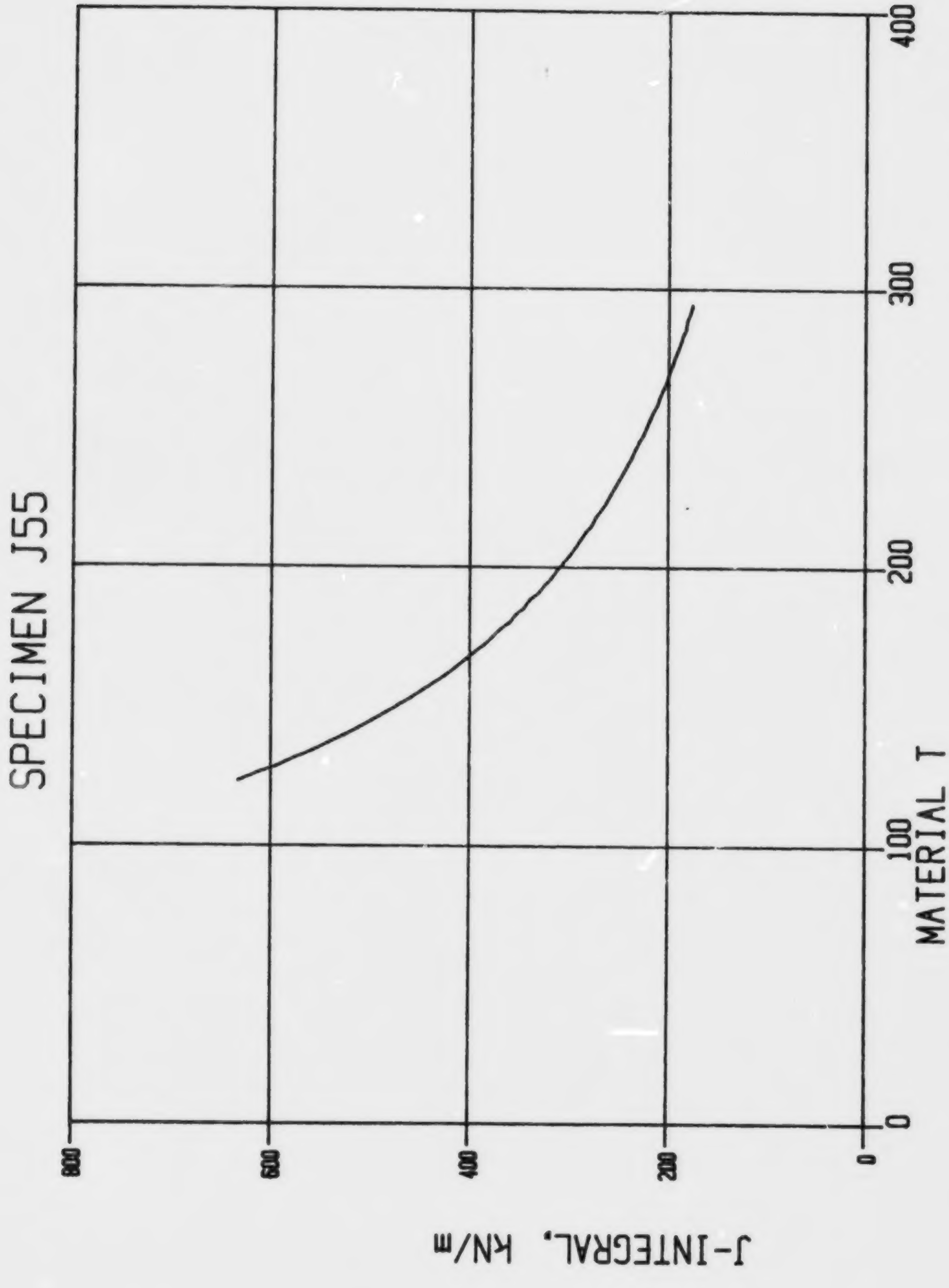
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
3.02	3.102	3.102	.12	.9996	1
6.57	3.091	3.092	.02	.9999	2
12.3	3.098	3.099	.094	.9999	3
21.44	3.102	3.103	.132	.9999	4
36.35	3.104	3.106	.161	.9997	5
58.49	3.098	3.101	.115	.9999	6
79.78	3.105	3.109	.193	.9997	7
102.21	3.109	3.115	.246	.9999	8
125.7	3.117	3.123	.328	.9999	9
151.04	3.116	3.124	.335	.9999	10
175.58	3.127	3.135	.453	.9997	11
201.1	3.133	3.142	.522	.9999	12
226.88	3.144	3.154	.643	.9998	13
254.97	3.145	3.156	.662	.9998	14
281.54	3.153	3.166	.756	.9999	15
307.55	3.167	3.18	.904	.9998	16
333.2	3.186	3.2	1.105	.9997	17
362.3	3.194	3.209	1.193	.9999	18
389.47	3.21	3.226	1.362	.9995	19
417.46	3.218	3.236	1.457	.9999	20
444.3	3.233	3.251	1.613	.9996	21
469.23	3.255	3.274	1.844	.9999	22
496.53	3.267	3.288	1.976	.9999	23
522.68	3.283	3.304	2.144	.9999	24
546.94	3.304	3.326	2.364	.9995	25
573.83	3.317	3.34	2.503	.9999	26
597.38	3.342	3.365	2.753	.9998	27
618.43	3.37	3.394	3.04	.9997	28
643.96	3.387	3.412	3.221	.9998	29
666.86	3.408	3.434	3.441	.9998	30

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J54
1	5.615	0	
2	8.972	.049	
3	13.062	.11	
4	16.785	.183	
5	19.958	.276	
6	22.095	.405	
7	22.766	.581	
8	23.499	.75	
9	24.231	.92	
10	24.78	1.096	
11	25.208	1.277	
12	25.635	1.458	
13	26.001	1.638	
14	26.306	1.824	
15	26.55	2.012	
16	26.794	2.197	
17	26.917	2.385	
18	27.039	2.578	
19	26.917	2.776	
20	26.855	2.976	
21	26.855	3.169	
22	26.794	3.367	
23	26.611	3.569	
24	26.489	3.767	
25	26.367	3.967	
26	26.245	4.17	
27	26.001	4.37	
28	25.513	4.583	
29	25.024	4.795	
30	24.658	5.007	
31	24.231	5.22	

	J(KN/M)	T	W	J54
1	138.37	3479.9	499.72	
2	163.31	205.32	24.83	
3	188.34	367.2	38.37	
4	213.99	208.65	19.07	
5	240.92	1510.5	122.51	
6	268.25	276.64	20.05	
7	294.55	173.45	11.36	
8	320.38	126.19	7.52	
9	347.75	325.12	17.76	
10	375.89	158.34	7.93	
11	403.46	289.91	13.46	
12	430.88	170.55	7.35	
13	456.77	106.32	4.27	
14	482.88	203.98	7.69	
15	509.6	153.43	5.43	
16	534.81	108.86	3.63	
17	560.38	189.89	5.99	
18	585.61	92.94	2.76	
19	607.9	72.23	2.03	
20	631.2	139.72	3.75	
21	655.41	102.51	2.62	

1000
900
800
700
600
500
400
300
200
100
0
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J55 (RT)
SLOPE 179
INTERCEPT 138
J1C 174


LEGEND
+ J55 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J55
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J55
MATERIAL TYPE	A105 FORGING
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	322.7
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	560.6
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.541
PERCENT SIDE GROOVE	21.172
SPECIMEN WIDTH W(CM)	5.084
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.12259775E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.15
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.091

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.179
INITIAL A/W	.608
AVERAGE CRACK EXTENSION 9PT(CM)	.325
DELTA A(CM) COMPLIANCE	.322
MAX DEVIATION OF SINGLE MEASUREMENT %	.63

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	12
LAST POINT	23
JIC(KN/M)	174
CORRELATION COEFF	.98
SLOPE M(MPa)	179
INTERCEPT B (KN/M)	138

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	442.31
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	369.02
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.993
25*JQ/EF.Y.(CM)	.985

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	12
LAST DATA POINT USED	30
CONSTANT(C1)	327.42
EXPONENT(C2)	.5957

J55(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
25.13	2.99	0	2.99	2.99	3.15	3.105	1
36.48	6.3	.08	6.38	6.38	6.79	3.095	2
47.28	10.58	1.66	12.24	12.24	12.91	3.112	3
55.67	14.66	7.13	21.79	21.78	22.78	3.103	4
61.03	17.62	19.76	37.38	37.37	38.57	3.105	5
62.92	18.73	40.04	58.77	58.81	60.01	3.108	6
65.26	20.15	59.93	80.08	80.27	81.38	3.114	7
67.28	21.42	81.35	102.77	102.92	104.16	3.113	8
69.37	22.77	102.77	125.54	126.05	126.97	3.12	9
71.61	24.26	124.79	149.05	150.58	150.47	3.135	10
72.9	25.14	149.02	174.16	175.77	175.63	3.136	11
73.78	25.75	175.53	201.28	202.31	202.85	3.13	12
76.05	27.36	197.61	224.97	228.66	226.46	3.153	13
77.23	28.22	223.65	251.86	256.17	253.37	3.157	14
78.56	29.2	249.31	278.51	284.24	279.99	3.167	15
80.5	30.66	273.46	304.12	312.5	305.57	3.183	16
81.37	31.33	301.04	332.37	341.63	333.82	3.188	17
82.86	32.48	325.97	358.45	371.59	359.81	3.207	18
83.97	33.36	353.1	386.46	402.5	387.75	3.22	19
84.99	34.17	379.19	413.36	433.47	414.55	3.236	20
85.9	34.91	403.62	438.53	465.29	439.54	3.262	21
86.73	35.58	429.94	465.52	496.85	466.43	3.278	22
87.28	36.04	456.12	492.15	528.78	492.92	3.296	23
87.54	36.26	483.15	519.4	560.48	520.05	3.309	24
88.92	37.41	505.88	543.29	592.12	543.83	3.332	25
89.28	37.71	534.26	571.97	625.23	572.41	3.344	26
90.25	38.54	560.85	599.39	657.22	599.77	3.356	27
91.02	39.19	582.79	621.99	689.78	622.21	3.38	28
91.6	39.7	606.6	646.29	723.58	646.36	3.402	29
90.96	39.15	635.87	675.01	757.09	674.92	3.413	30

H(M)	D(M)	POISSON'S RATIO
.01906	2.54E-03	.3

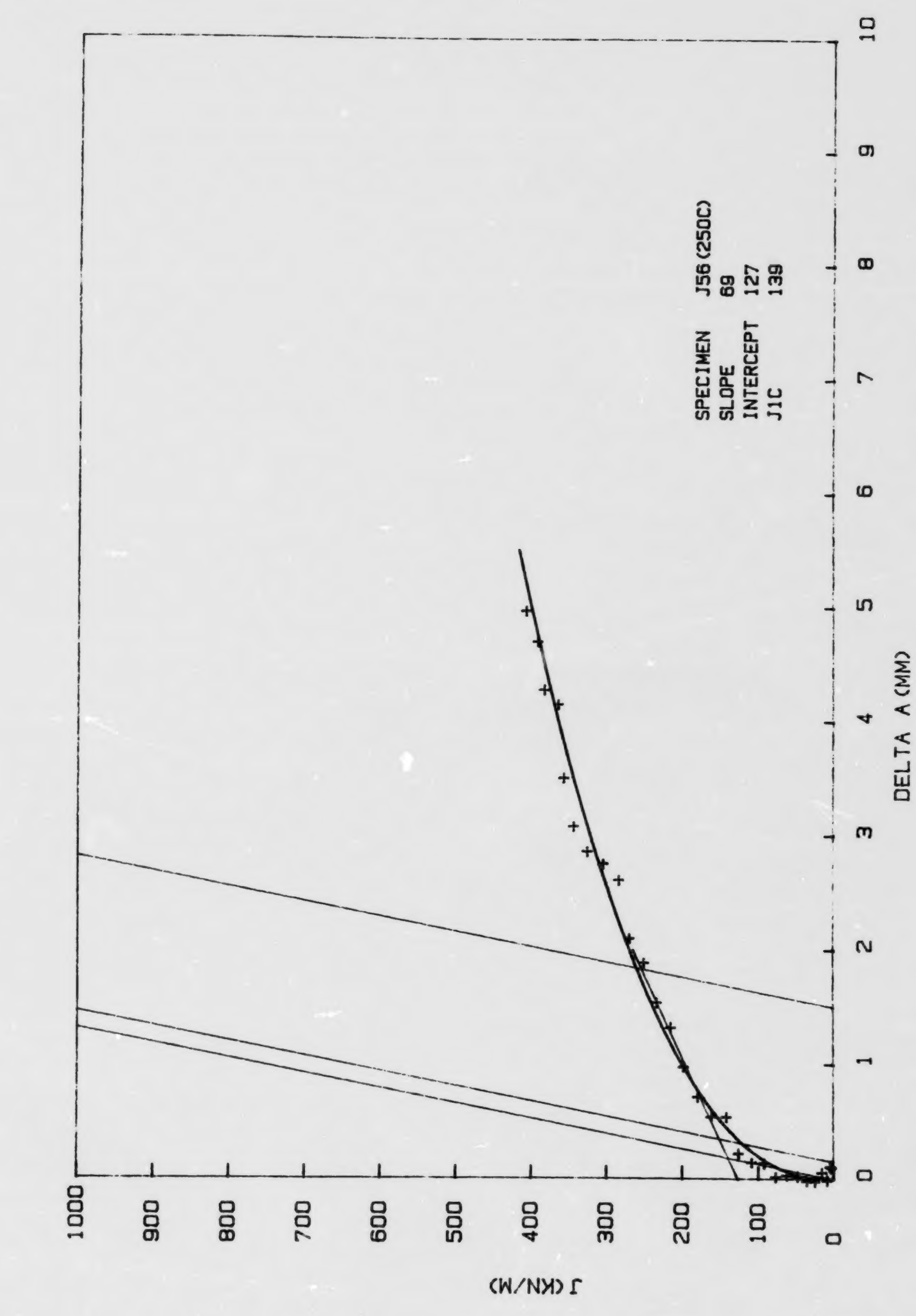
J55

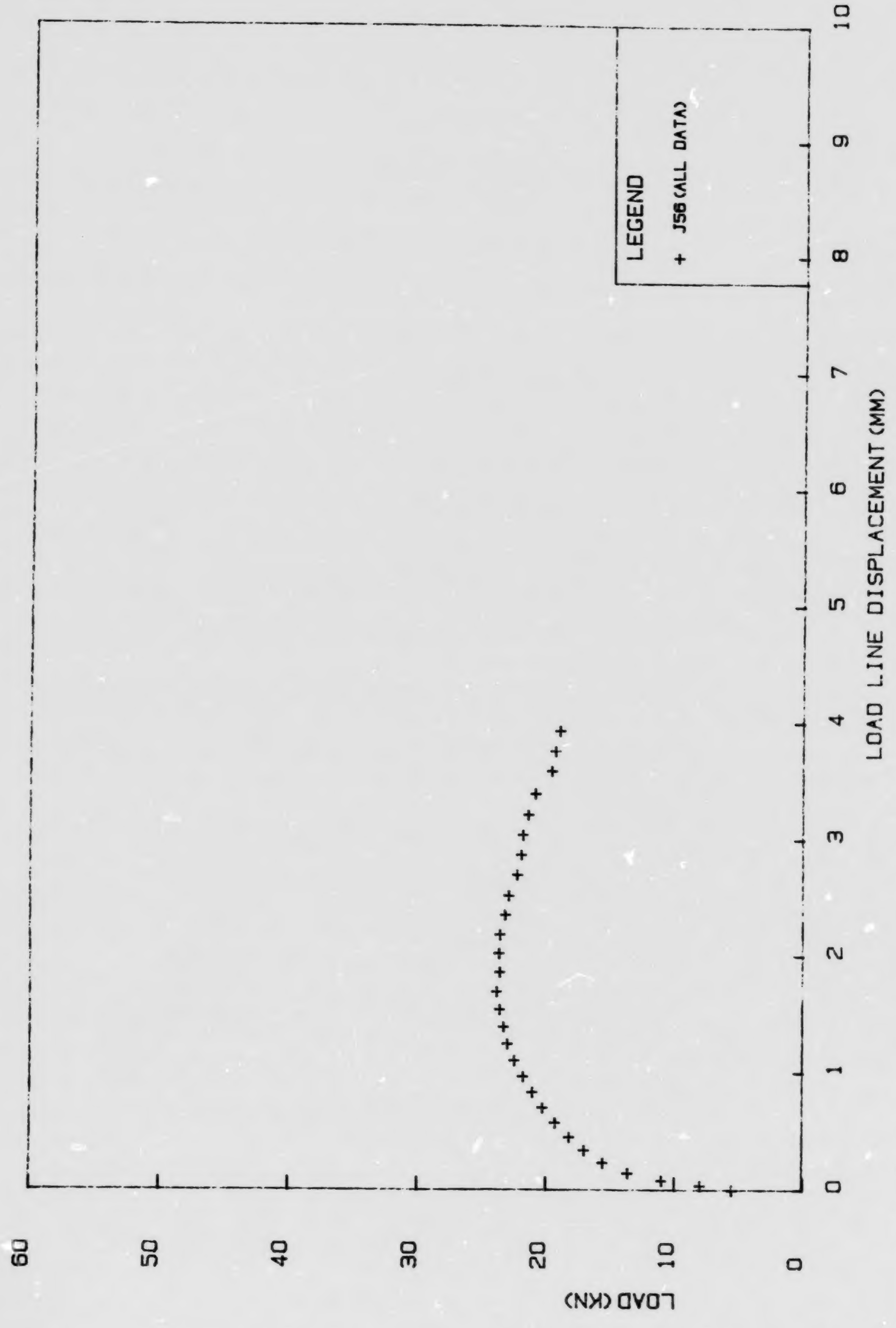
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.99	3.105	3.105	.14	.9994	1
6.38	3.095	3.095	.043	.9999	2
12.24	3.111	3.112	.21	.9999	3
21.79	3.102	3.103	.123	1	4
37.38	3.102	3.105	.137	.9999	5
58.77	3.105	3.108	.174	1	6
80.08	3.11	3.114	.228	.9999	7
102.77	3.108	3.113	.22	.9998	8
125.54	3.113	3.12	.287	.9999	9
149.05	3.127	3.135	.436	.9999	10
174.16	3.127	3.136	.447	1	11
201.28	3.12	3.13	.388	.9999	12
224.97	3.142	3.153	.617	.9999	13
251.86	3.146	3.157	.664	.9998	14
278.51	3.155	3.167	.759	.9998	15
304.12	3.169	3.183	.917	.9998	16
332.37	3.173	3.188	.965	.9997	17
358.45	3.191	3.207	1.156	.9999	18
386.46	3.203	3.22	1.286	.9999	19
413.36	3.219	3.236	1.454	.9997	20
438.53	3.244	3.262	1.708	.9997	21
465.52	3.259	3.278	1.87	.9997	22
492.15	3.275	3.296	2.045	.9999	23
519.4	3.288	3.309	2.183	.9998	24
543.29	3.31	3.332	2.408	.9998	25
571.97	3.321	3.344	2.53	.9997	26
599.39	3.332	3.356	2.648	.9997	27
621.99	3.355	3.38	2.892	.9998	28
646.29	3.377	3.402	3.113	.9997	29
675.01	3.386	3.413	3.219	.9997	30

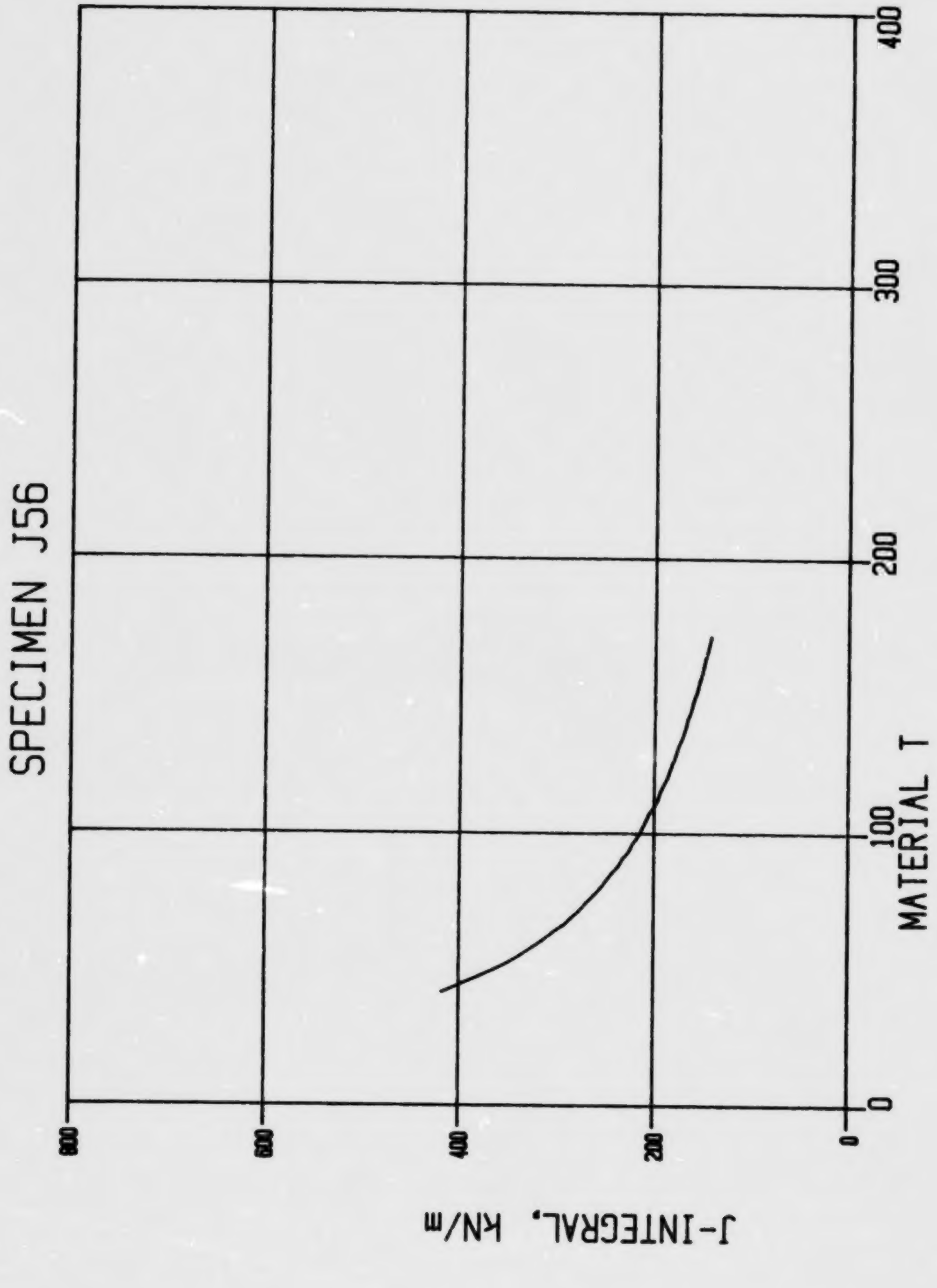
J55

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	5.554	0
2	8.972	.049
3	13.123	.107
4	16.785	.183
5	19.897	.278
6	21.79	.415
7	22.4	.591
8	23.132	.762
9	23.865	.935
10	24.475	1.108
11	24.963	1.289
12	25.391	1.467
13	25.818	1.65
14	26.123	1.836
15	26.428	2.021
16	26.672	2.209
17	26.978	2.397
18	27.161	2.585
19	27.222	2.781
20	27.283	2.979
21	27.222	3.176
22	26.917	3.381
23	26.794	3.582
24	26.55	3.784
25	26.306	3.984
26	26.184	4.187
27	26.001	4.395
28	26.001	4.595
29	25.635	4.802
30	25.269	5.017
31	24.841	5.227

	J(KN/M)	T	W	J55
1	161.61	2345.16	286.71	
2	187.72	-453.8	-47.91	
3	213.12	102.08	9.38	
4	238.42	567.13	46.48	
5	265.19	274.41	20.12	
6	291.31	159.96	10.59	
7	318.24	579.81	35.04	
8	345.41	135.22	7.45	
9	372.45	211.35	10.73	
10	399.91	158.34	7.42	
11	425.94	97.59	4.23	
12	452.03	164.64	6.67	
13	478.84	149.6	5.67	
14	505.78	195.27	6.95	
15	531.35	104.63	3.5	
16	557.63	232.8	7.37	
17	585.68	228.74	6.84	
18	610.69	91.31	2.58	
19	634.14	108.38	2.91	
20	660.65	267	6.85	


SPECIMEN J56 (250C)
SLOPE 69
INTERCEPT 127
J1C 139
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J56 (ALL DATA)


SPECIMEN J56
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                    J56
 MATERIAL TYPE                                      A105 FORGING
 MATERIAL CONDITION                                 PARENT
 TEST TEMPERATURE(DEG C)                            250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          231
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        528.8
 CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
 SPECIMEN THICKNESS B(CM)                           2.54
 PERCENT SIDE GROOVE                                20.787
 SPECIMEN WIDTH W(CM)                               5.083
 YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
 EFFECTIVE MODULUS(Pa)                              2.04089709E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN              10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           24.1
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.087

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                     3.181
 INITIAL A/W                                        .607
 AVERAGE CRACK EXTENSION 9PT(CM)                    .538
 DELTA A(CM) COMPLIANCE                             .497
 MAX DEVIATION OF SINGLE MEASUREMENT %              .77

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    14
 LAST POINT                     18
 JIC(KN/M)                      139
 CORRELATION COEFF              .99
 SLOPE M(MPa)                   69
 INTERCEPT B (KN/M)             127

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                           NO
 CRACK SIZE DA<0.15*DELTA A                         YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    382.18
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  284.78
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   1.996
 25*JQ/EF.Y.(CM)                                    .915

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED       14
 LAST DATA POINT USED      29
 CONSTANT(C1)              200.5
 EXPONENT(C2)              .4308
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J56(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.23	2.46	.01	2.47	2.47	2.61	3.097	1
30.56	4.65	.03	4.68	4.68	4.97	3.098	2
37.5	7	1.96	8.97	8.97	9.44	3.086	3
43.12	9.26	6.44	15.7	15.71	16.3	3.093	4
46.89	10.95	14.15	25.1	25.08	25.85	3.085	5
50.1	12.5	23.46	35.96	35.94	36.81	3.085	6
53.3	14.14	34.14	48.28	48.32	49.22	3.09	7
56.03	15.63	46.46	62.09	62.14	63.13	3.09	8
58.16	16.84	60.2	77.04	77.06	78.17	3.089	9
60.75	18.38	73.7	92.08	92.56	93.25	3.101	10
62.66	19.55	89.12	108.67	109.18	109.92	3.102	11
64.58	20.76	105.02	125.78	126.75	127.08	3.109	12
67.14	22.44	119.16	141.6	144.76	142.84	3.141	13
68.04	23.05	137.99	161.04	164.23	162.32	3.141	14
69.7	24.19	155.21	179.39	184.14	180.64	3.158	15
70.49	24.74	173.61	198.35	205.81	199.47	3.185	16
72.74	26.34	188.86	215.2	226.69	216.23	3.219	17
73.92	27.21	206.76	233.97	248.29	234.91	3.241	18
74.83	27.88	223.44	251.32	270.67	252.1	3.276	19
75.44	28.33	241.86	270.19	292.86	270.86	3.297	20
76.68	29.28	255.05	284.33	315.77	284.81	3.348	21
76.63	29.24	275.61	304.84	338.92	305.21	3.362	22
76.97	29.5	296.2	325.69	361.94	326	3.373	23
77.03	29.54	314.54	344.09	385.11	344.25	3.395	24
78.16	30.42	326.49	356.91	407.83	356.94	3.437	25
78.2	30.44	333.96	364.4	431.27	364.29	3.502	26
78.22	30.46	352.66	383.13	453.29	382.92	3.515	27
80.16	31.99	360.43	392.42	474.3	392.19	3.557	28
79.82	31.72	376.2	407.92	497.61	407.5	3.584	29

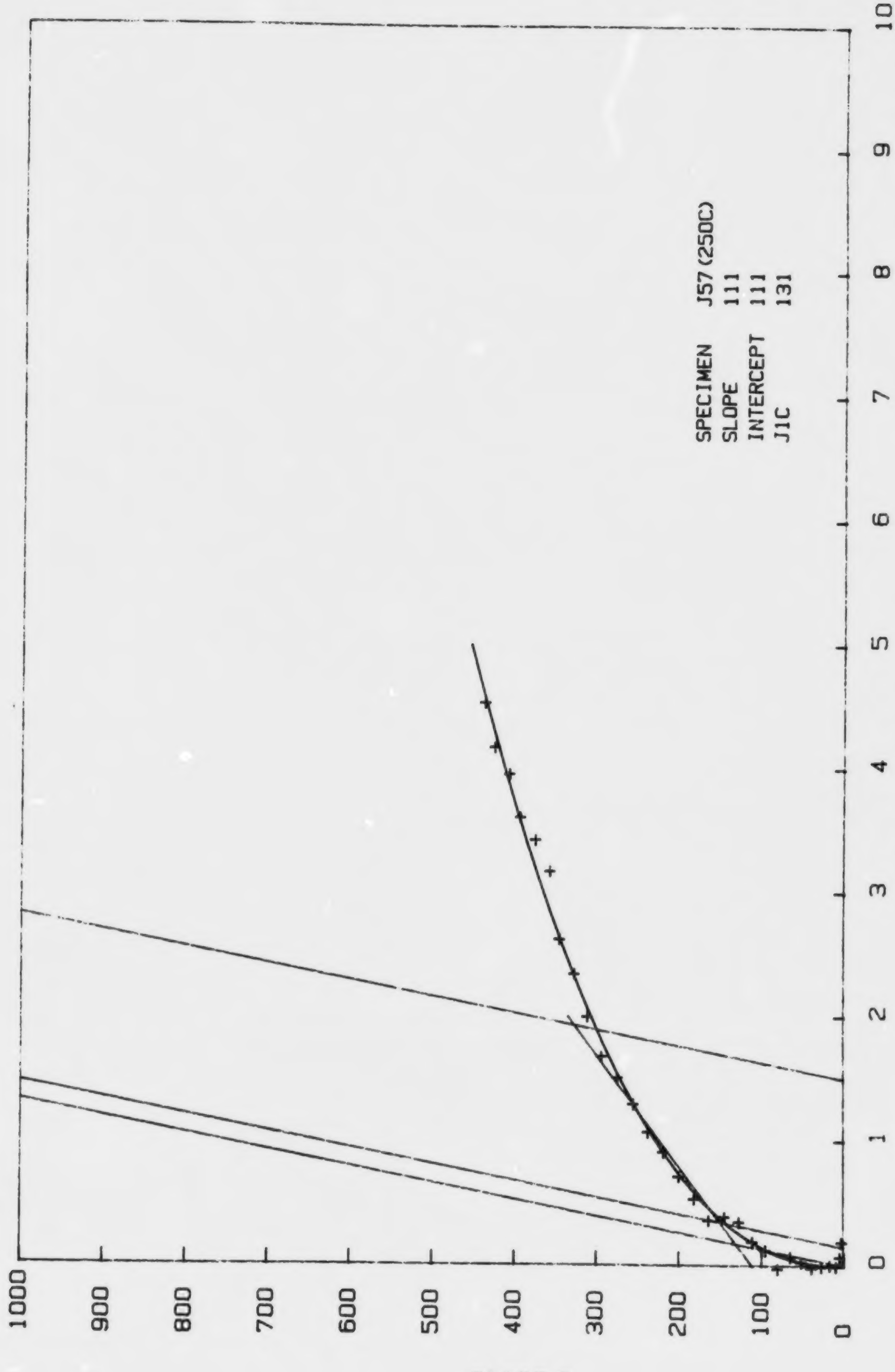
H(M)	D(M)	POISSON'S RATIO
.01901	2.54E-03	.3

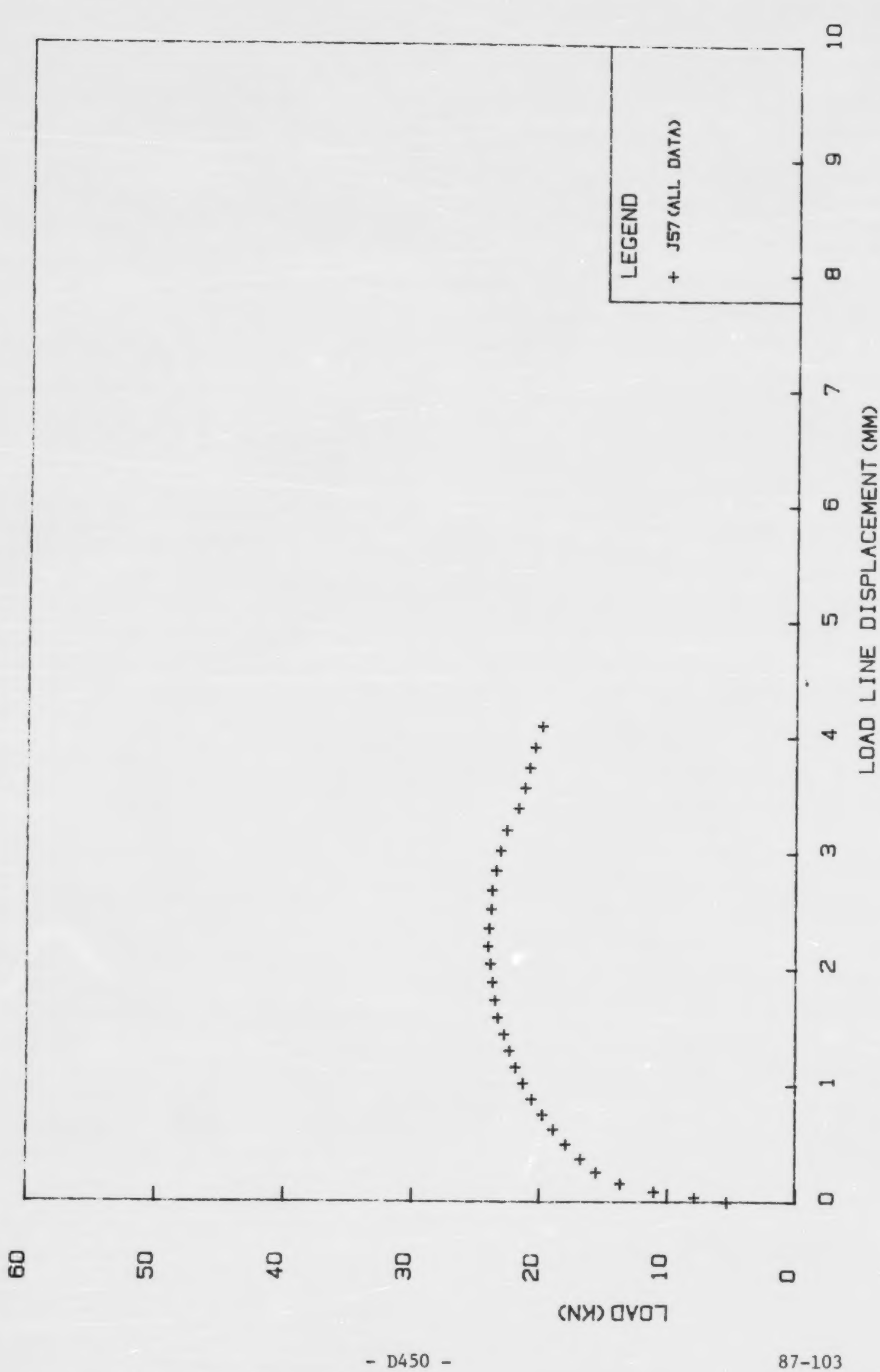
J56

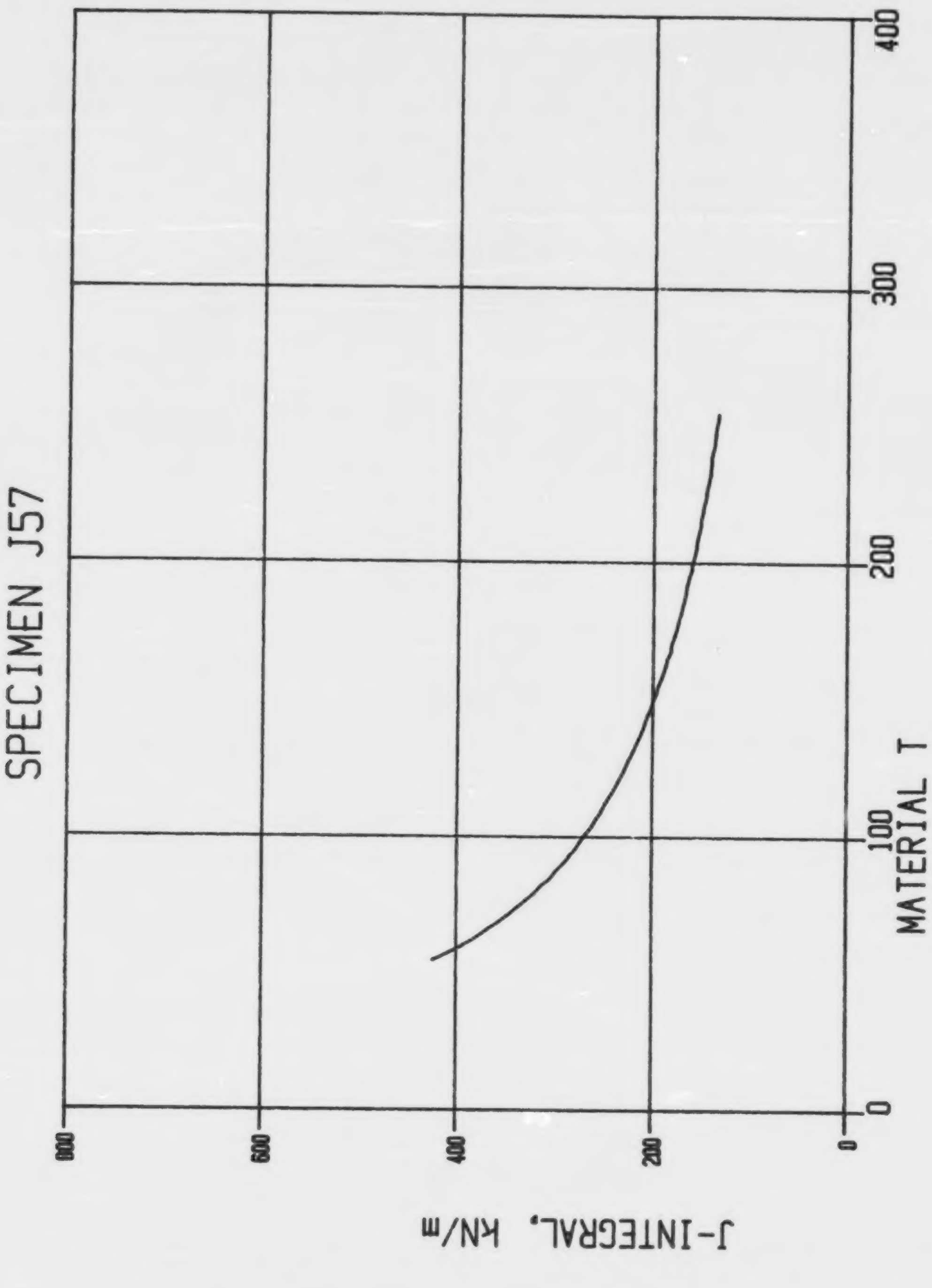
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.47	3.097	3.097	.101	.9992	1
4.68	3.098	3.098	.111	.9999	2
8.97	3.085	3.086	-.011	.9999	3
15.7	3.091	3.093	.057	.9998	4
25.1	3.083	3.085	-.019	.9999	5
35.96	3.083	3.085	-.015	.9998	6
48.28	3.086	3.09	.026	.9997	7
62.09	3.086	3.09	.033	.9998	8
77.04	3.084	3.089	.02	.9998	9
92.08	3.095	3.101	.139	.9999	10
108.67	3.095	3.102	.145	.9999	11
125.78	3.102	3.109	.222	1	12
141.6	3.133	3.141	.541	.9995	13
161.04	3.133	3.141	.544	.9995	14
179.39	3.149	3.158	.715	.9999	15
198.35	3.174	3.185	.976	.9998	16
215.2	3.208	3.219	1.319	.9996	17
233.97	3.229	3.241	1.538	.9999	18
251.32	3.264	3.276	1.888	.9998	19
270.19	3.284	3.297	2.1	.9997	20
284.33	3.335	3.348	2.611	.9999	21
304.84	3.348	3.362	2.753	.9998	22
325.69	3.358	3.373	2.861	.9999	23
344.09	3.379	3.395	3.081	.9999	24
356.91	3.421	3.437	3.505	.9998	25
364.4	3.486	3.502	4.15	.9999	26
383.13	3.498	3.515	4.276	.9999	27
392.42	3.54	3.557	4.698	.9996	28
407.92	3.566	3.584	4.968	.9998	29

```
           LOAD(KN)     LOAD LINE DISPLACEMENT(MM)     J56
 1          5.493        0
 2          7.996         .038
 3         10.986         .083
 4         13.611         .148
 5         15.564         .234
 6         17.029         .339
 7         18.188         .453
 8         19.287         .575
 9         20.264         .703
 10        21.057         .835
 11        21.79          .969
 12        22.461        1.106
 13        23.01         1.248
 14        23.315        1.394
 15        23.621        1.542
 16        23.865        1.694
 17        23.621        1.86
 18        23.682        2.021
 19        23.621        2.183
 20        23.193        2.352
 21        22.949        2.517
 22        22.278        2.697
 23        21.973        2.867
 24        21.851        3.037
 25        21.423        3.212
 26        20.874        3.391
 27        19.592        3.588
 28        19.348        3.757
 29        18.982        3.931
 30        18.372        4.116
```

	J(KN/M)	T	W	J56
1	133.69	62.68	7.19	
2	151.32	8090.56	819.7	
3	170.22	136.34	12.17	
4	188.87	91.99	7.3	
5	206.78	62.16	4.42	
6	224.58	108.54	7.03	
7	242.64	62.7	3.69	
8	260.75	112.79	6.1	
9	277.26	35.06	1.73	
10	294.59	182.38	8.41	
11	315.27	244.62	10.48	
12	334.89	106.18	4.23	
13	350.5	38.29	1.42	
14	360.66	14.72	.51	
15	373.76	187.35	6.21	
16	387.77	27.89	.87	
17	400.17	72.92	2.16	


SPECIMEN J57(250C)
SLOPE 111
INTERCEPT 111
J1C 131
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J57 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J57
J-INTEGRAL, kN/m
MATERIAL T
0
100
200
300
400
0
200
400
600
800

J57(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.29	2.47	.03	2.5	2.5	2.62	3.113	1
30.98	4.78	.17	4.95	4.95	5.26	3.101	2
38.12	7.23	2.38	9.61	9.61	10.11	3.094	3
43.42	9.39	7.8	17.19	17.19	17.84	3.095	4
46.78	10.89	16.64	27.54	27.53	28.3	3.093	5
49.98	12.43	26.92	39.35	39.33	40.23	3.092	6
52.89	13.93	38.18	52.11	52.18	53.07	3.097	7
55.47	15.32	50.34	65.66	65.83	66.7	3.101	8
57.42	16.42	64.5	80.91	80.77	82.09	3.092	9
59.99	17.92	77.94	95.86	96.34	97.06	3.107	10
62.05	19.17	92.65	111.82	112.65	113.08	3.113	11
64.25	20.55	107.35	127.91	129.7	129.18	3.129	12
65.69	21.48	123.94	145.42	147.5	146.73	3.133	13
66.93	22.3	142.18	164.49	166.33	165.88	3.13	14
68.59	23.42	158.71	182.13	185.6	183.5	3.148	15
70.14	24.49	176.15	200.64	206	201.98	3.165	16
71.82	25.68	193.5	219.18	226.83	220.49	3.185	17
73.35	26.79	211.22	238.01	247.77	239.3	3.201	18
74.57	27.69	228.23	255.92	268.91	257.14	3.223	19
75.38	28.29	246.92	275.21	291.59	276.33	3.245	20
76.3	28.99	265.72	294.71	313.99	295.77	3.262	21
77.48	29.88	282.33	312.21	337.44	313.14	3.294	22
78.67	30.82	297.66	328.47	360.63	329.27	3.328	23
79	31.08	315.71	346.78	384.92	347.41	3.356	24
79.79	31.7	326.78	358.48	409.19	358.93	3.411	25
79.92	31.8	344.39	376.19	433.08	376.48	3.436	26
79.93	31.81	363.18	394.99	456.58	395.15	3.454	27
81.06	32.72	375.73	408.45	479.76	408.51	3.489	28
80.62	32.36	394.19	426.55	504.16	426.43	3.511	29
80.58	32.33	406.81	439.14	527.88	438.85	3.547	30

H(M)	D(M)	POISSON'S RATIO
.01901	2.54E-03	.3

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                  J57
 MATERIAL TYPE                                    A105 FORGING
 MATERIAL CONDITION                               PARENT
 TEST TEMPERATURE(DEG C)                          250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        231
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      528.8
 CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
 SPECIMEN THICKNESS B(CM)                         2.542
 PERCENT SIDE GROOVE                              21.518
 SPECIMEN WIDTH W(CM)                             5.08
 YOUNGS MODULUS AT TEST TEMP(Pa)                  1.82776E+11
 EFFECTIVE MODULUS(Pa)                            1.94758626E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN            10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         24.25
 INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.094

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                   3.158
 INITIAL A/W                                      .609
 AVERAGE CRACK EXTENSION 9PT(CM)                  .504
 DELTA A(CM) COMPLIANCE                           .453
 MAX DEVIATION OF SINGLE MEASUREMENT %            .77

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   12
 LAST POINT                    21
 JIC(KN/M)                     131
 CORRELATION COEFF             .96
 SLOPE M(MPa)                  111
 INTERCEPT B (KN/M)            111

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD      YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD         YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                         NO
 CRACK SIZE DA<0.15*DELTA A                       YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  378.95
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                291.27
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 1.986
 25*JQ/EF.Y.(CM)                                  .862

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

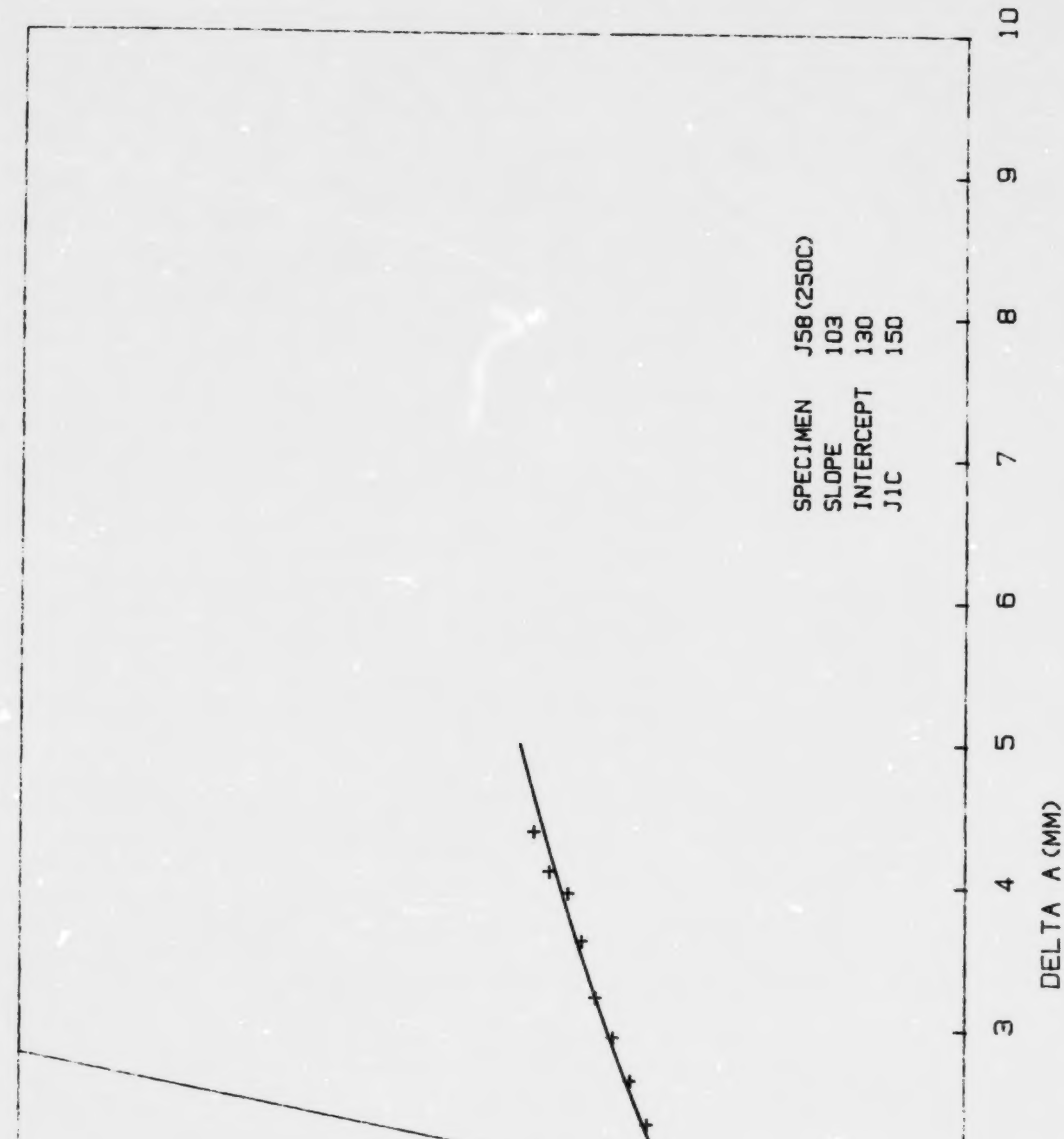
 1st DATA POINT USED      12
 LAST DATA POINT USED     30
 CONSTANT(C1)             228.22
 EXPONENT(C2)             .4299
```

J57

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.5	3.113	3.113	.192	.9997	1
4.95	3.101	3.101	.071	.9998	2
9.61	3.093	3.094	-2E-03	.9996	3
17.19	3.093	3.095	5E-03	.9999	4
27.54	3.091	3.093	-8E-03	.9998	5
39.35	3.09	3.092	-.016	.9997	6
52.11	3.094	3.097	.031	.9998	7
65.66	3.097	3.101	.074	.9997	8
80.91	3.087	3.092	-.024	.9999	9
95.86	3.101	3.107	.125	.9998	10
111.82	3.107	3.113	.194	.9996	11
127.91	3.122	3.129	.352	.9999	12
145.42	3.125	3.133	.392	.9998	13
164.49	3.121	3.13	.363	.9998	14
182.13	3.138	3.148	.536	.9999	15
200.64	3.155	3.165	.714	.9999	16
219.18	3.174	3.185	.908	.9999	17
238.01	3.189	3.201	1.069	.9999	18
255.92	3.211	3.223	1.293	.9996	19
275.21	3.231	3.245	1.509	.9998	20
294.71	3.248	3.262	1.678	.9999	21
312.21	3.279	3.294	1.998	.9999	22
328.47	3.313	3.328	2.344	.9999	23
346.78	3.34	3.356	2.623	.9998	24
358.48	3.395	3.411	3.169	.9999	25
376.19	3.419	3.436	3.421	.9999	26
394.99	3.437	3.454	3.601	.9997	27
408.45	3.471	3.489	3.952	.9998	28
426.55	3.492	3.511	4.167	.9998	29
439.14	3.528	3.547	4.526	.9998	30

```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J57
  1          5.31         0
  2          7.874        .04
  3          11.047       .089
  4          13.672       .159
  5          15.564       .254
  6          16.785       .37
  7          17.944       .493
  8          18.921       .62
  9          19.775       .748
  10         20.63        .88
  11         21.301       1.017
  12         21.912       1.154
  13         22.4         1.294
  14         22.827       1.434
  15         23.315       1.578
  16         23.56        1.727
  17         23.743       1.882
  18         23.926       2.039
  19         24.109       2.192
  20         24.048       2.347
  21         23.865       2.512
  22         23.804       2.673
  23         23.499       2.845
  24         23.132       3.016
  25         22.644       3.193
  26         21.729       3.381
  27         21.24        3.558
  28         20.874       3.732
  29         20.447       3.91
  30         19.897       4.093
  31         19.165       4.28
```

	J(KN/M)	T	W	J57
1	136.66	552.19	62.11	
2	154.95	-826.48	-82.11	
3	173.31	129.46	11.4	
4	191.39	131.5	10.39	
5	209.91	120.96	8.62	
6	228.6	148.33	9.63	
7	246.97	101.04	6	
8	265.57	113.54	6.2	
9	284.96	145.6	7.34	
10	303.46	69.26	3.22	
11	320.34	59.55	2.57	
12	337.63	83.05	3.35	
13	352.63	27.15	1.01	
14	367.33	88.93	3.14	
15	385.59	132.1	4.4	
16	401.72	48.66	1.52	
17	417.5	106.69	3.17	
18	432.84	44.36	1.24	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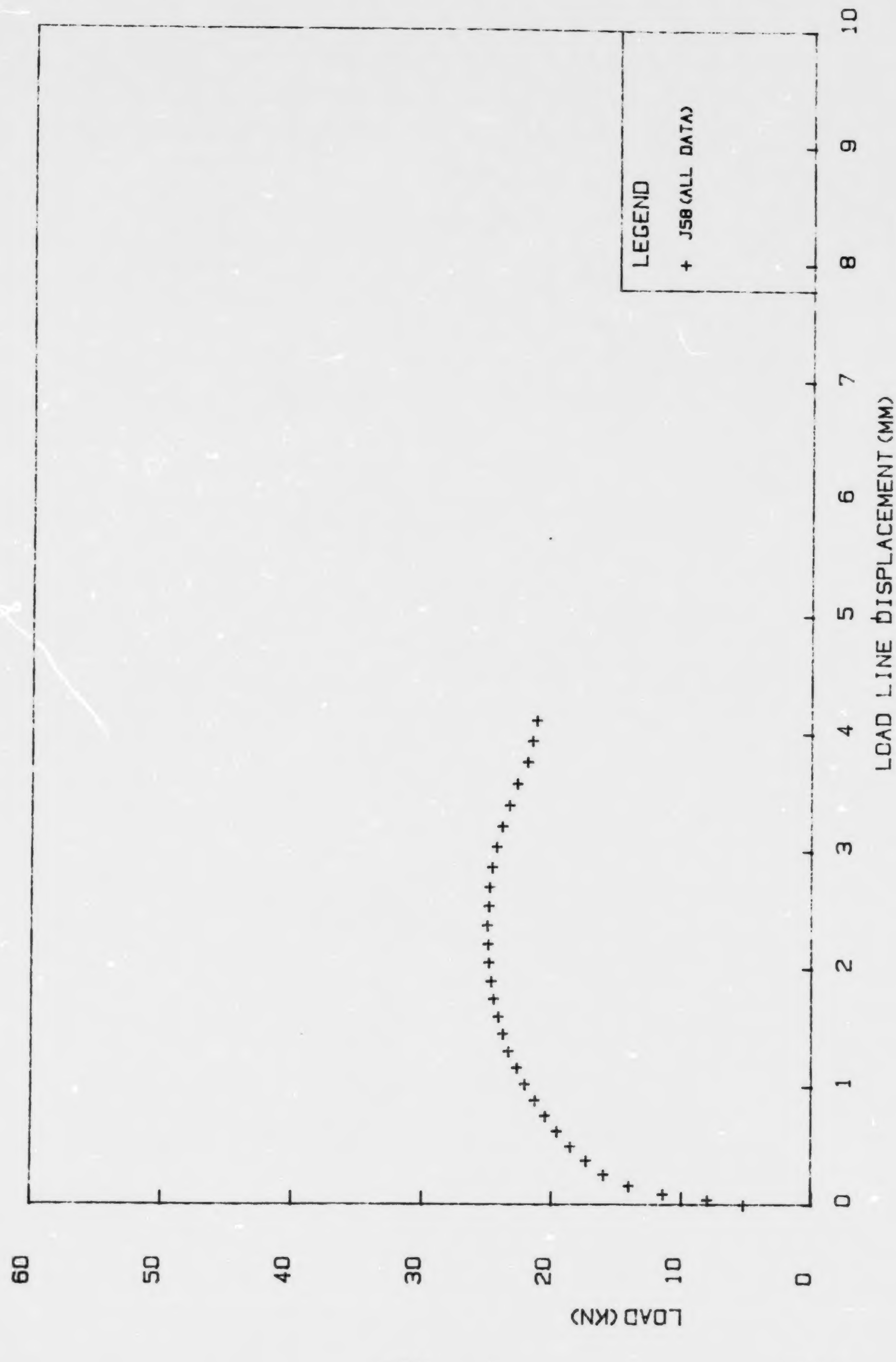
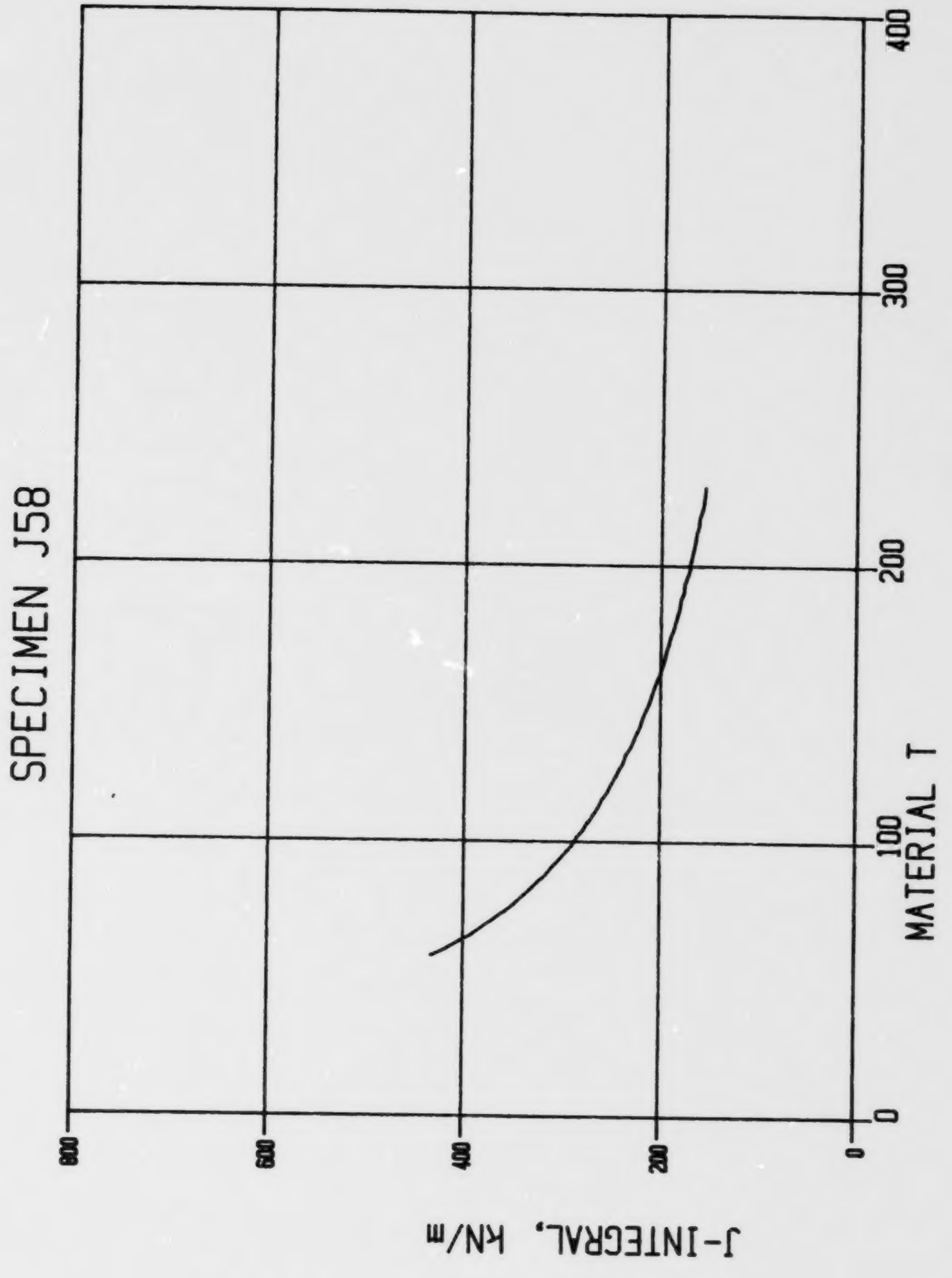
SLOPE 103
INTERCEPT 130
J1C 150
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J58 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J58
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

J58(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
21.76	2.36	-.03	2.33	2.33	2.49	3.067	1
31.19	4.84	.02	4.87	4.87	5.19	3.072	2
38.26	7.29	2.36	9.65	9.65	10.15	3.068	3
43.41	9.38	7.99	17.37	17.36	18.03	3.063	4
46.91	10.96	16.9	27.86	27.83	28.64	3.059	5
50.31	12.6	27.03	39.63	39.63	40.51	3.062	6
53.54	14.27	38.14	52.41	52.59	53.36	3.072	7
56.07	15.65	51.12	66.77	66.96	67.81	3.072	8
58.55	17.07	64.37	81.44	81.85	82.54	3.079	9
60.7	18.34	79.06	97.4	97.79	98.6	3.078	10
62.51	19.45	94.95	114.41	114.93	115.66	3.081	11
64.78	20.89	110.23	131.12	132.15	132.43	3.089	12
66.65	22.12	126.93	149.04	151.03	150.36	3.103	13
67.69	22.82	145.66	168.48	170.49	169.85	3.103	14
69.69	24.18	162.59	186.77	190.46	188.13	3.12	15
71.51	25.46	178.95	204.41	210.52	205.72	3.143	16
72.83	26.41	197.94	224.34	232.05	225.64	3.156	17
74.23	27.43	215.8	243.23	253.61	244.48	3.177	18
75.31	28.24	235.24	263.48	275.96	264.69	3.191	19
76.67	29.27	252.64	281.91	298.72	283.02	3.218	20
77.42	29.84	273.01	302.85	322.12	303.91	3.232	21
79	31.07	289.08	320.15	345.45	321.11	3.264	22
80.36	32.15	304.96	337.11	369.76	337.94	3.301	23
81.14	32.78	322.12	354.9	394.16	355.58	3.331	24
81.5	33.07	339.99	373.06	419.33	373.57	3.361	25
81.44	33.03	358.7	391.72	444.9	392.04	3.389	26
81.64	33.18	373.08	406.26	470.02	406.39	3.429	27
82.92	34.23	386.85	421.08	494.18	421.11	3.462	28
82.98	34.28	406.47	440.75	518.35	440.68	3.477	29
82.15	33.6	423.83	457.43	543.82	457.13	3.505	30

H(M)	D(M)	POISSON'S RATIO
.01901	2.54E-03	.3

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      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

  SPECIMEN NUMBER                                  J58
  MATERIAL TYPE                                    A105 FORGING
  MATERIAL CONDITION                               PARENT
  TEST TEMPERATURE(DEG C)                          250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)        231
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)      528.8
  CRACK PLANE ORIENTATION (PER ASTM E399)          L-C
  SPECIMEN THICKNESS B(CM)                         2.54
  PERCENT SIDE GROOVE                              21.062
  SPECIMEN WIDTH W(CM)                             5.081
  YOUNGS MODULUS AT TEST TEMP(Pa)                  1.82776E+11
  EFFECTIVE MODULUS(Pa)                            2.05149181E+11

                 FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN            10
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM         23.75
  INITIAL CRACK LENGTH-COMPLIANCE(CM)              3.067

                 CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                   3.156
  INITIAL A/W                                      .604
  AVERAGE CRACK EXTENSION 9PT(CM)                  .46
  DELTA A(CM) COMPLIANCE                           .438
  MAX DEVIATION OF SINGLE MEASUREMENT %            .64

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                         15
  LAST POINT                          21
  JIC(KN/M)                           150
  CORRELATION COEFF                   .99
  SLOPE M(MPa)                        103
  INTERCEPT B (KN/M)                  130

                 VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD            YES
  LIGAMENT>25JIC/EFFECTIVE YIELD      YES
  DJ/DA<EFFECTIVE YIELD               YES

                 QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                         YES
  CRACK SIZE DA<0.15*DELTA A                       YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                  380.85
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                299.32
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                 2.014
  25*JQ/EF.Y.(CM)                                  .987

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED            15
  LAST DATA POINT USED           30
  CONSTANT(C1)                   237.19
  EXPONENT(C2)                   .4283
```
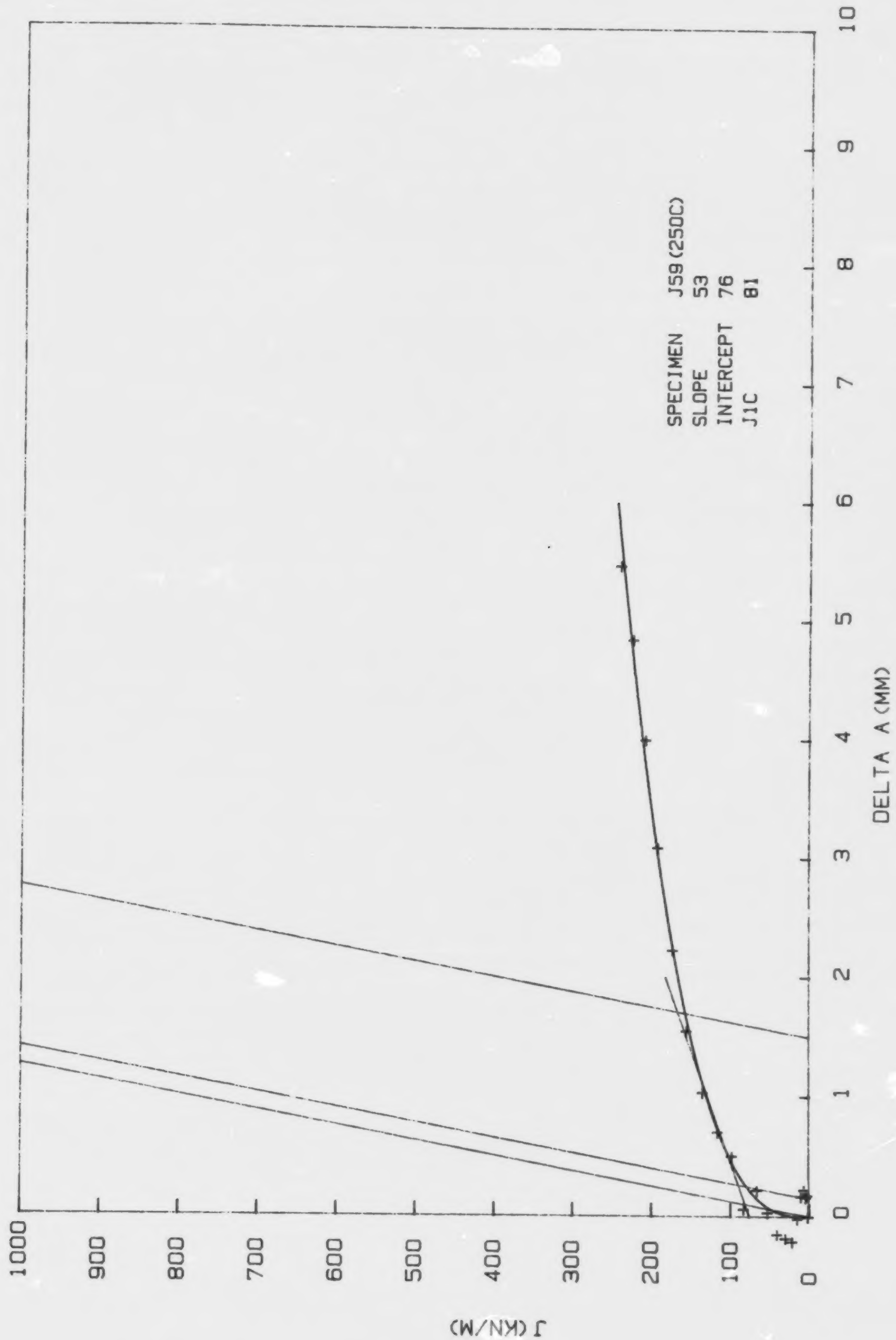
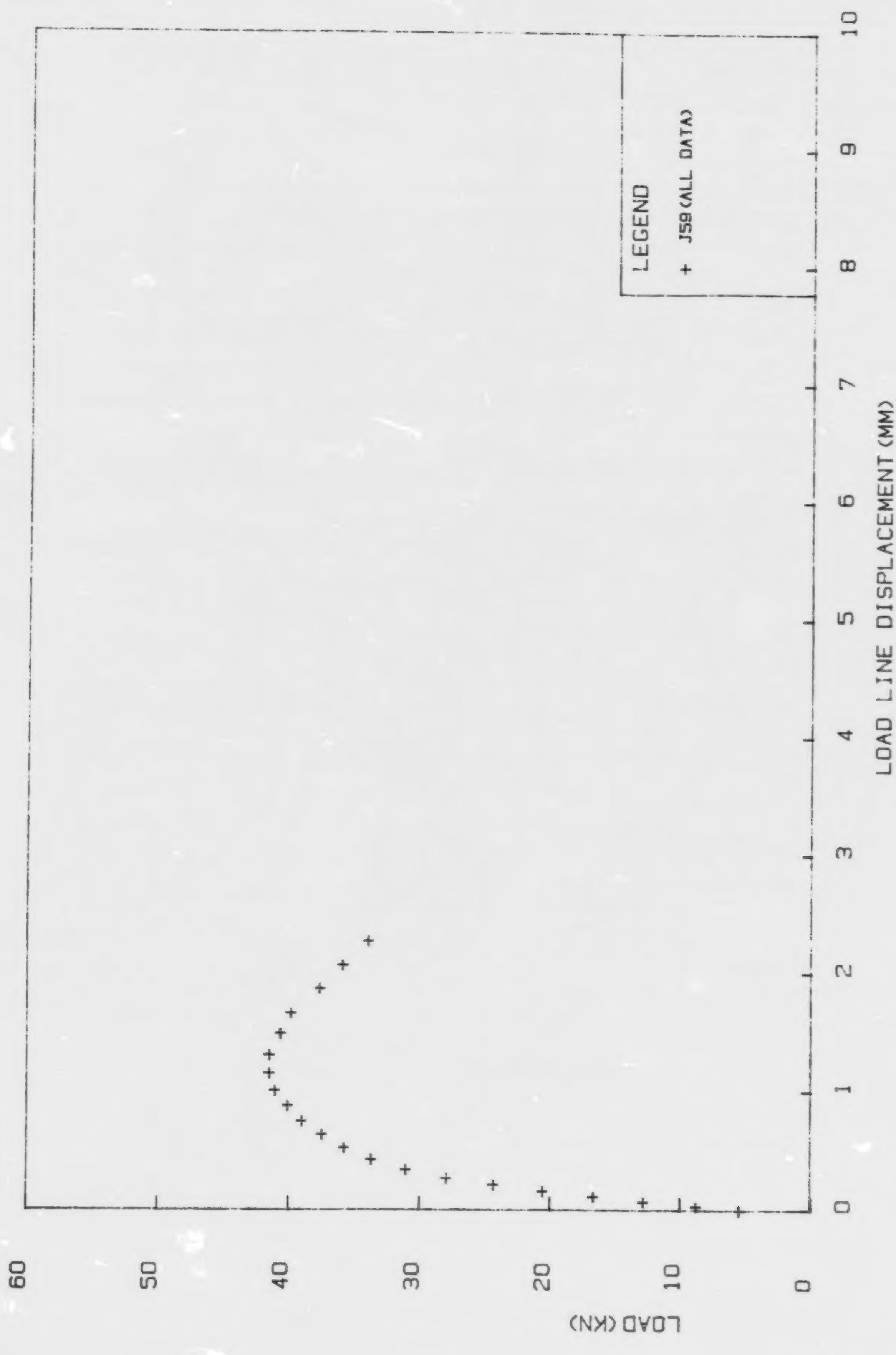

J58

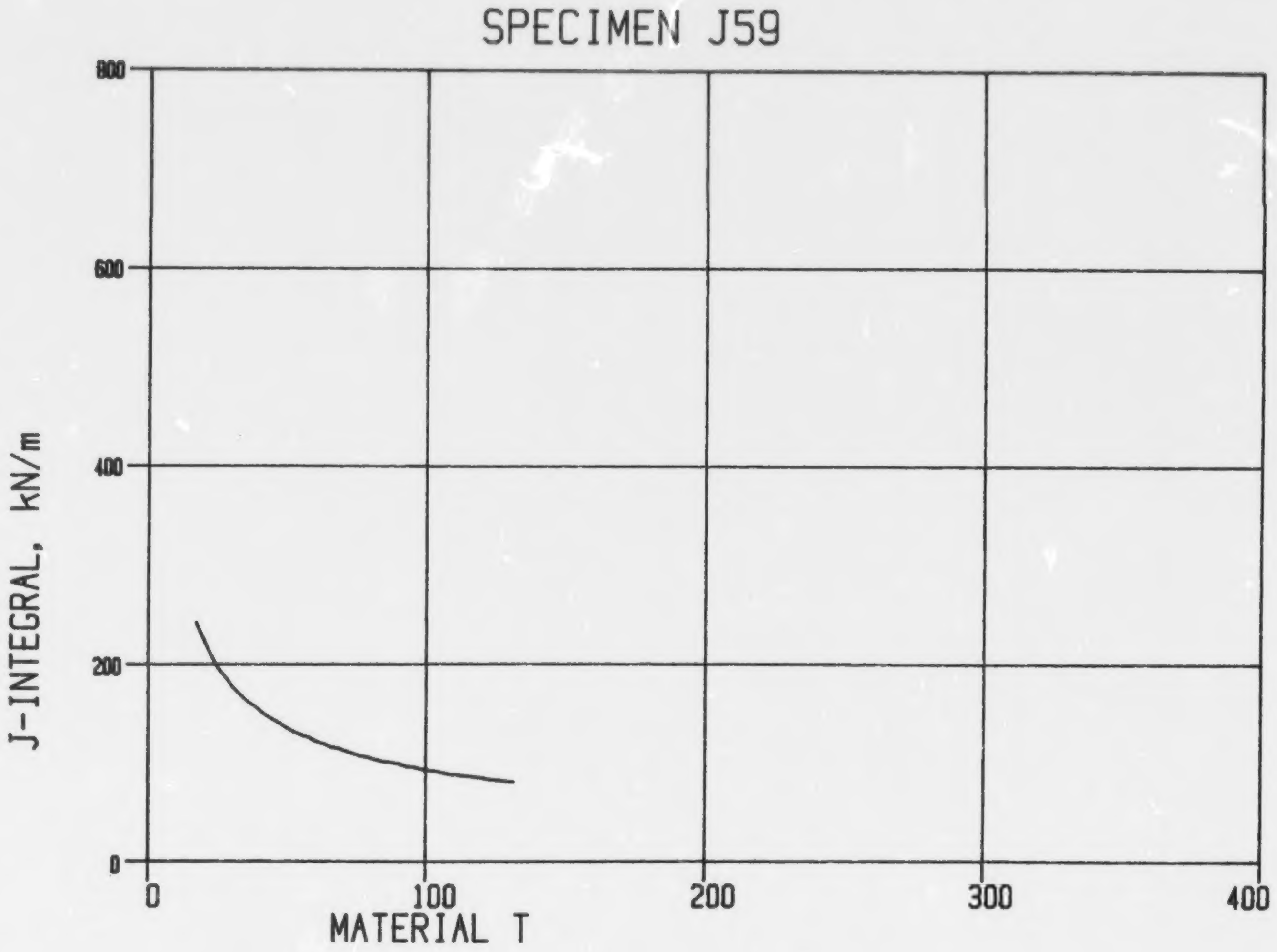
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.33	3.066	3.067	-3E-03	.9994	1
4.87	3.071	3.072	.048	.9999	2
9.65	3.067	3.068	.013	.9998	3
17.37	3.062	3.063	-.039	.9994	4
27.86	3.057	3.059	-.078	.9997	5
39.63	3.059	3.062	-.054	.9999	6
52.41	3.068	3.072	.046	.9998	7
66.77	3.068	3.072	.052	.9999	8
81.44	3.074	3.079	.121	.9998	9
97.4	3.073	3.078	.114	.9999	10
114.41	3.074	3.081	.141	.9999	11
131.12	3.082	3.089	.224	.9998	12
149.04	3.094	3.103	.356	.9999	13
168.48	3.094	3.103	.359	.9999	14
186.77	3.111	3.12	.535	.9979	15
204.41	3.132	3.143	.761	.9998	16
224.34	3.145	3.156	.894	.9998	17
243.23	3.164	3.177	1.096	1	18
263.48	3.178	3.191	1.241	.9999	19
281.91	3.204	3.218	1.512	.9996	20
302.85	3.218	3.232	1.654	.9998	21
320.15	3.249	3.264	1.973	.9998	22
337.11	3.285	3.301	2.337	.9998	23
354.9	3.315	3.331	2.642	.9996	24
373.06	3.344	3.361	2.944	.9999	25
391.72	3.372	3.389	3.221	.9998	26
406.26	3.411	3.429	3.619	.9997	27
421.08	3.444	3.462	3.951	.9994	28
440.75	3.458	3.477	4.103	.9997	29
457.43	3.486	3.505	4.382	.9998	30

```
            LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J58
 1           5.188          0
 2           7.996          .039
 3          11.414          .09
 4          14.038          .161
 5          15.991          .256
 6          17.334          .372
 7          18.555          .494
 8          19.592          .621
 9          20.508          .753
 10         21.301          .885
 11         22.095          1.019
 12         22.705          1.16
 13         23.376          1.298
 14         23.804          1.445
 15         24.17           1.592
 16         24.536          1.743
 17         24.719          1.893
 18         24.902          2.05
 19         24.963          2.206
 20         25.024          2.365
 21         24.902          2.528
 22         24.841          2.692
 23         24.658          2.859
 24         24.292          3.033
 25         23.865          3.207
 26         23.315          3.386
 27         22.705          3.569
 28         21.912          3.756
 29         21.545          3.936
 30         21.24           4.109
 31         20.447          4.298
```

	J(KN/M)	T	W	J58
1	158.76	8101.26	797.04	
2	177.63	131.75	11.48	
3	195.59	98.66	7.72	
4	214.38	189.25	13.42	
5	233.79	118.41	7.62	
6	253.36	177.82	10.47	
7	272.69	86.04	4.64	
8	292.38	187.1	9.34	
9	311.5	68.55	3.16	
10	328.63	59.1	2.53	
11	346	73.87	2.95	
12	363.98	76.15	2.84	
13	382.39	85.15	2.97	
14	398.99	46.25	1.51	
15	413.67	56.49	1.75	
16	430.91	164.56	4.84	
17	449.09	75.57	2.09	


SPECIMEN J59(250C)
SLOPE 53
INTERCEPT 76
J1C 81
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J59 (ALL DATA)
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LOAD (KN)
0
10
20
30
40
50
60


SPECIMEN J59
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

```
    DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

SPECIMEN NUMBER                                     J59
MATERIAL TYPE                                       A106B
MATERIAL CONDITION                                  PARENT
TEST TEMPERATURE(DEG C)                             250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           268.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         525.5
CRACK PLANE ORIENTATION (PER ASTM E399)             C-L
SPECIMEN THICKNESS B(CM)                            3.18
PERCENT SIDE GROOVE                                 20
SPECIMEN WIDTH W(CM)                                6.362
YOUNGS MODULUS AT TEST TEMP(Pa)                     1.82776E+11
EFFECTIVE MODULUS(Pa)                               1.96946643E+11

                 FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN               12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            18.69
INITIAL CRACK LENGTH-COMPLIANCE(CM)                 3.627

                 CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                      3.701
INITIAL A/W                                         .57
AVERAGE CRACK EXTENSION 9PT(CM)                     .563
DELTA A(CM) COMPLIANCE                              .546
MAX DEVIATION OF SINGLE MEASUREMENT %               .49

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                            13
LAST POINT                             16
JIC(KN/M)                              81
CORRELATION COEFF                      .97
SLOPE M(MPa)                           53
INTERCEPT B (KN/M)                     76

                 VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD          YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD             YES

                 QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                            NO
CRACK SIZE DA<0.15*DELTA A                          YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     504.86
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   434.36
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.735
25*JQ/EF.Y.(CM)                                     .51

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED         13
LAST DATA POINT USED        21
CONSTANT(C1)                130.58
EXPONENT(C2)                .3527
```

J59(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
14.94	1.11	0	1.11	1.11	1.17	3.627	1
22.01	2.41	-.04	2.38	2.38	2.5	3.644	2
28.59	4.07	.31	4.38	4.38	4.58	3.643	3
35.42	6.25	.7	6.94	6.94	7.26	3.649	4
41.81	8.7	1.93	10.63	10.63	11.09	3.644	5
47.48	11.23	4.13	15.35	15.33	15.95	3.625	6
52.2	13.57	8.53	22.1	22.04	22.84	3.606	7
56.7	16.01	14.71	30.72	30.67	31.58	3.609	8
60.31	18.11	23.35	41.46	41.44	42.42	3.612	9
63.84	20.29	33.26	53.56	53.74	54.6	3.63	10
67.14	22.45	44.46	66.91	67.39	68.02	3.648	11
68.43	23.31	60.47	83.78	83.92	84.98	3.633	12
71.89	25.73	72.85	98.57	100.01	99.79	3.677	13
73.49	26.89	89.52	116.41	118.56	117.63	3.697	14
74.94	27.96	107.45	135.41	139.03	136.57	3.73	15
75.7	28.53	127.32	155.85	162.24	156.82	3.782	16
77.39	29.82	143.83	173.65	184.42	174.44	3.85	17
77.25	29.71	163.25	192.96	210.14	193.35	3.936	18
78.18	30.43	178.3	208.74	233.79	208.83	4.026	19
78.37	30.58	194.17	224.75	258.05	224.51	4.111	20
78.4	30.61	210.06	240.67	280.79	240.19	4.173	21

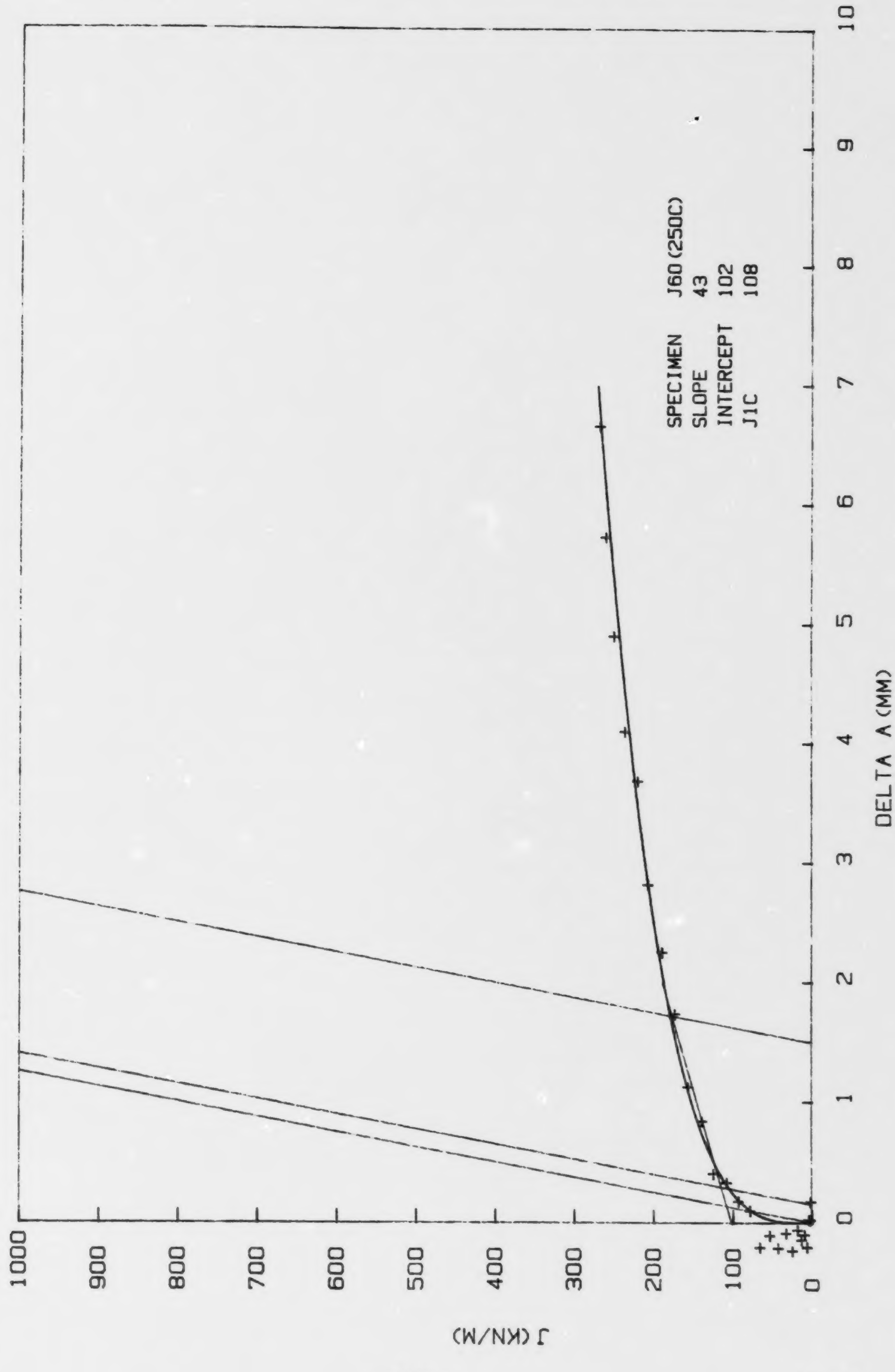
H(M)	D(M)	POISSON'S RATIO
.02386	2.54E-03	.3

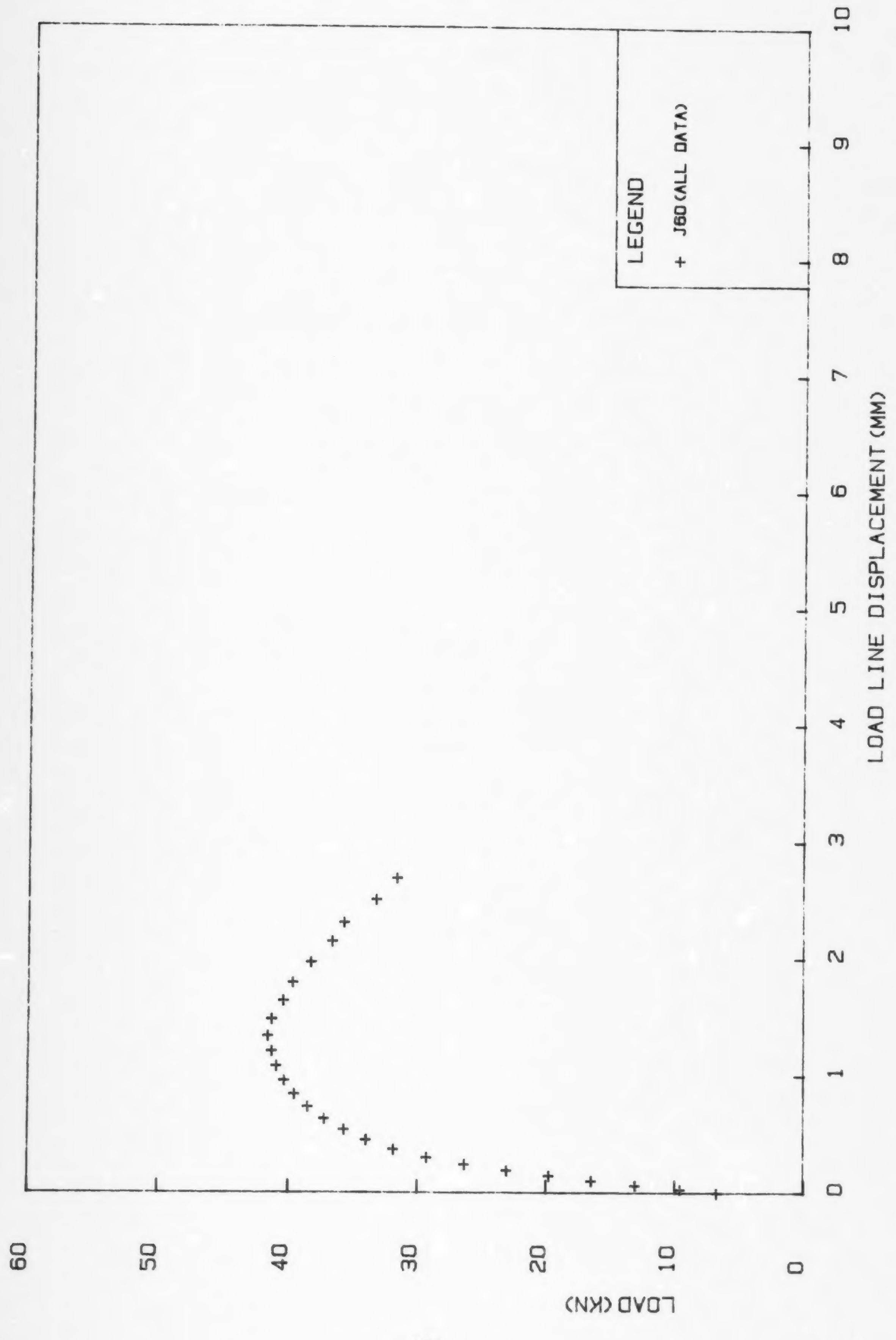
J59

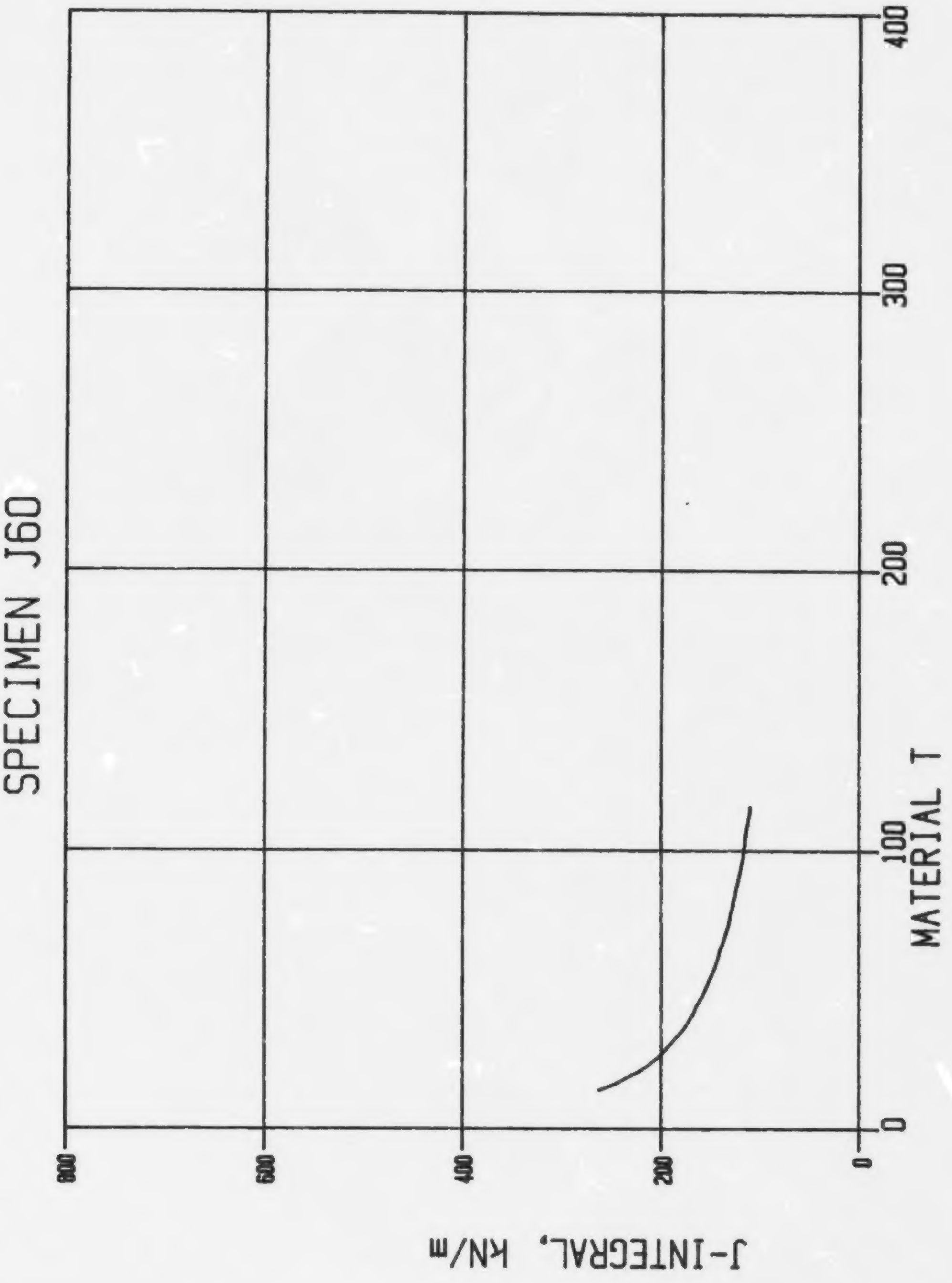
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.11	3.627	3.627	-3E-03	.9986	1
2.38	3.644	3.644	.174	.9997	2
4.38	3.642	3.643	.156	.9994	3
6.94	3.648	3.649	.219	.9994	4
10.63	3.642	3.644	.165	.9996	5
15.35	3.623	3.625	-.02	.9994	6
22.1	3.604	3.606	-.212	.9998	7
30.72	3.606	3.609	-.184	.9994	8
41.46	3.609	3.612	-.151	.9993	9
53.56	3.626	3.63	.031	.9996	10
66.91	3.644	3.648	.215	.9993	11
83.78	3.628	3.633	.06	.9997	12
98.57	3.671	3.677	.499	.9997	13
116.41	3.69	3.697	.699	.9995	14
135.41	3.722	3.73	1.031	.9996	15
155.85	3.773	3.782	1.547	.9997	16
173.65	3.84	3.85	2.226	.9994	17
192.96	3.926	3.936	3.087	.9996	18
208.74	4.016	4.026	3.994	.9997	19
224.75	4.1	4.111	4.838	.9998	20
240.67	4.161	4.173	5.462	.9997	21

```
            LOAD(KN)     LOAD LINE DISPLACEMENT(MM)      J59
 1           5.432        0
 2           8.789         .032
 3          12.817         .071
 4          16.663         .115
 5          20.569         .16
 6          24.353         .212
 7          27.954         .269
 8          31.067         .339
 9          33.691         .425
 10         35.767         .524
 11         37.476         .632
 12         39.001         .747
 13         40.1           .875
 14         41.077        1.006
 15         41.504        1.147
 16         41.504        1.304
 17         40.649        1.483
 18         39.856        1.659
 19         37.659        1.868
 20         35.889        2.067
 21         33.936        2.273
 22         32.471        2.466
```

	J(KN/M)	T	W	J59
1	75.34	-126.7	-39.55	
2	91.18	39.16	9.94	
3	107.49	103.33	22.08	
4	125.91	66.35	11.95	
5	145.63	46.02	7.03	
6	164.75	30.43	4	
7	183.31	26.02	2.97	
8	200.85	20.17	2.02	
9	216.74	22	1.97	
10	232.71	29.61	2.4	


SPECIMEN J60 (250C)
SLOPE 43
INTERCEPT 102
J1C 108
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J60 (ALL DATA)


SPECIMEN J60
MATERIAL T
0
100
200
300
400
0
200
400
600
800
J-INTEGRAL, kN/m

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J60
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	268.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	525.5
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	3.177
PERCENT SIDE GROOVE	20.018
SPECIMEN WIDTH W(CM)	6.365
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	1.96136841E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	18.85
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.643

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.729
INITIAL A/W	.572
AVERAGE CRACK EXTENSION 9PT(CM)	.684
DELTA A(CM) COMPLIANCE	.666
MAX DEVIATION OF SINGLE MEASUREMENT %	.67

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	15
LAST POINT	19
JIC(KN/M)	108
CORRELATION COEFF	.94
SLOPE M(MPa)	43
INTERCEPT B (KN/M)	102

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	504.26
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	408.06
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.722
25*JQ/EF.Y.(CM)	.68

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	15
LAST DATA POINT USED	26
CONSTANT(C1)	152.67
EXPONENT(C2)	.2956

J60(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
16.6	1.37	.02	1.39	1.39	1.45	3.66	1
22.43	2.51	.09	2.6	2.6	2.72	3.645	2
28.31	3.99	.44	4.43	4.43	4.63	3.645	3
33.53	5.6	1.31	6.91	6.9	7.2	3.622	4
39.35	7.71	2.13	9.84	9.84	10.24	3.632	5
44.86	10.02	3.88	13.9	13.9	14.43	3.628	6
50.08	12.49	6.32	18.81	18.82	19.45	3.636	7
53.93	14.48	11.25	25.73	25.69	26.5	3.619	8
58.03	16.76	16.82	33.59	33.63	34.46	3.634	9
60.52	18.23	25.48	43.71	43.65	44.68	3.621	10
63.48	20.06	34.23	54.29	54.36	55.33	3.632	11
65.29	21.23	45.75	66.97	66.88	68.1	3.622	12
68.24	23.18	55.77	78.95	79.53	80.13	3.652	13
69.92	24.34	69.29	93.63	94.43	94.85	3.66	14
71.62	25.54	83.11	108.65	109.97	109.89	3.676	15
72.57	26.22	98.92	125.14	126.76	126.4	3.683	16
75.01	28.02	111.5	139.51	143.27	140.78	3.727	17
75.73	28.55	128.35	156.9	162.23	158.11	3.755	18
76.84	29.4	143.95	173.35	182.61	174.41	3.816	19
77.92	30.23	159.23	189.46	202.53	190.41	3.868	20
77.9	30.21	176.84	207.06	224.79	207.79	3.924	21
78.93	31.02	189.12	220.13	245.99	220.68	4.011	22
79.15	31.19	205.31	236.5	266.62	236.9	4.053	23
77.82	30.15	220.36	250.51	289.69	250.57	4.133	24
78.69	30.83	229.81	260.64	310.17	260.56	4.215	25
79.73	31.65	236.49	268.14	330.21	267.96	4.309	26

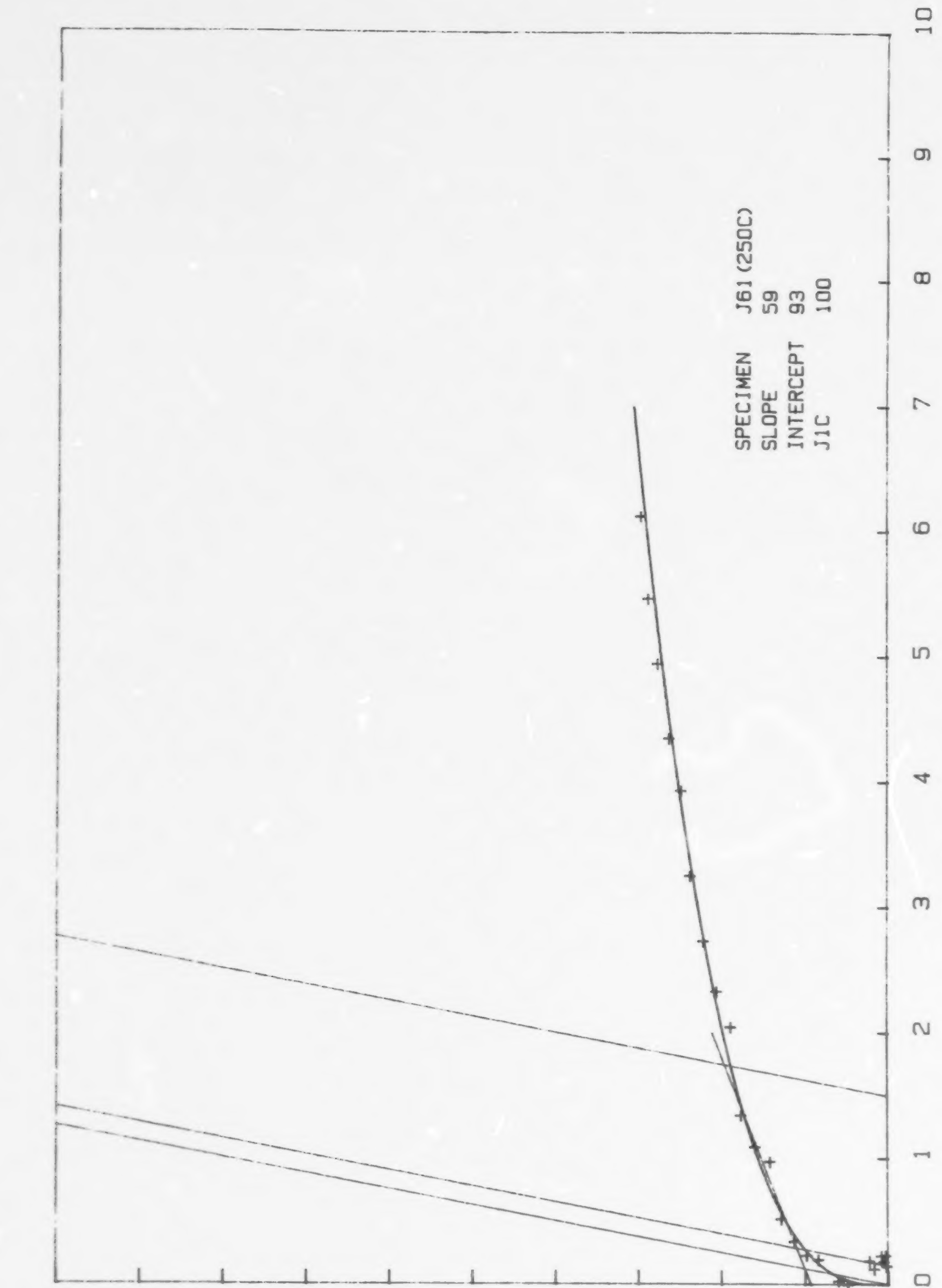
H(M)	D(M)	POISSON'S RATIO
.02385	2.54E-03	.3

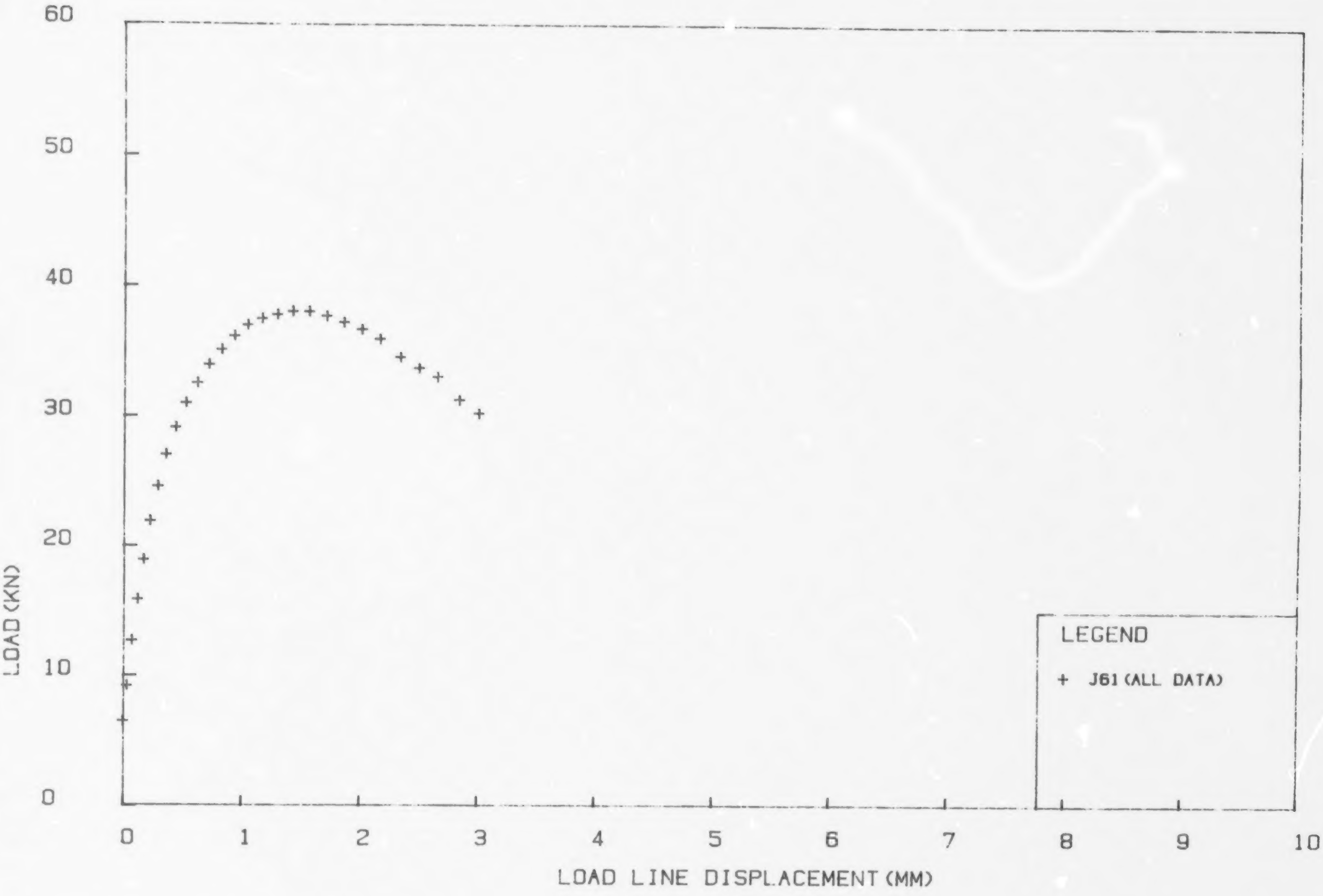
J60

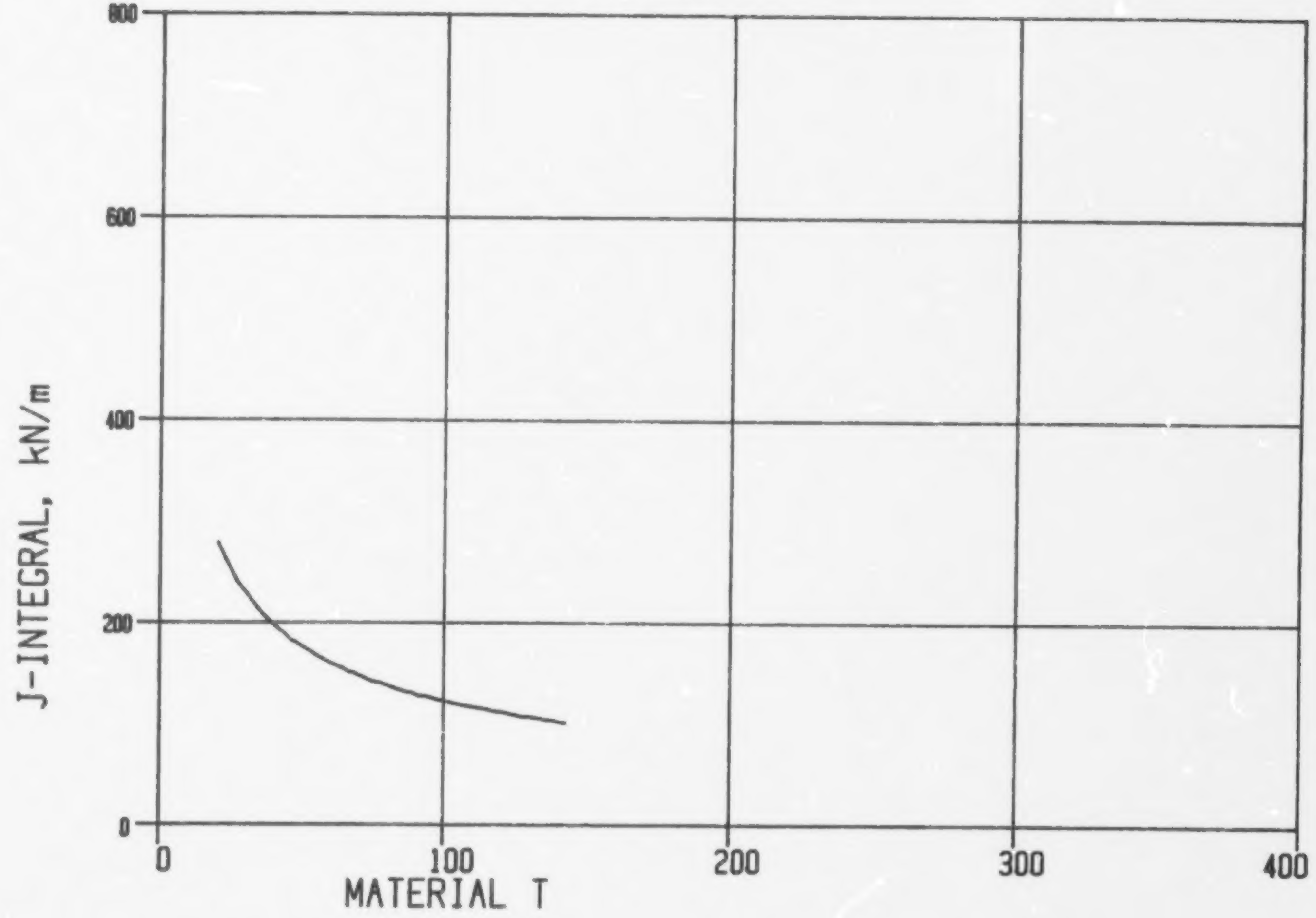
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.39	3.66	3.66	.17	.9986	1
2.6	3.644	3.645	.017	.9993	2
4.43	3.644	3.645	.02	.9996	3
6.91	3.621	3.622	-.21	.9996	4
9.84	3.631	3.632	-.105	.9998	5
13.9	3.627	3.628	-.149	.9993	6
18.81	3.635	3.636	-.066	.9991	7
25.73	3.617	3.619	-.24	.9999	8
33.59	3.631	3.634	-.093	.9997	9
43.71	3.618	3.621	-.217	.9992	10
54.29	3.628	3.632	-.112	.9994	11
66.97	3.617	3.622	-.211	.9996	12
78.95	3.647	3.652	.095	.9997	13
93.63	3.655	3.66	.174	.9996	14
108.65	3.669	3.676	.329	.9992	15
125.14	3.676	3.683	.403	.9996	16
139.51	3.719	3.727	.842	.9995	17
156.9	3.747	3.755	1.125	.9995	18
173.35	3.807	3.816	1.734	.9997	19
189.46	3.858	3.868	2.251	.9994	20
207.06	3.914	3.924	2.814	.9996	21
220.13	4	4.011	3.682	.9995	22
236.5	4.041	4.053	4.096	.9999	23
250.51	4.12	4.133	4.896	.9998	24
260.64	4.203	4.215	5.724	.9997	25
268.14	4.296	4.309	6.658	.9998	26

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J60
1	6.714	0	
2	9.583	.029	
3	13.062	.063	
4	16.479	.104	
5	19.775	.146	
6	23.071	.192	
7	26.367	.244	
8	29.297	.302	
9	31.86	.371	
10	33.997	.449	
11	35.706	.538	
12	37.231	.632	
13	38.513	.735	
14	39.551	.841	
15	40.344	.958	
16	40.955	1.079	
17	41.321	1.206	
18	41.626	1.335	
19	41.321	1.478	
20	40.405	1.638	
21	39.673	1.793	
22	38.269	1.968	
23	36.621	2.145	
24	35.706	2.308	
25	33.203	2.505	
26	31.616	2.688	
27	29.846	2.875	

	J(KN/M)	T	W	J60
1	101.14	112.4	25.76	
2	116.89	257.33	50.88	
3	132.33	38.03	6.53	
4	148.21	71.37	10.83	
5	165.12	31.31	4.16	
6	181.4	36.17	4.29	
7	198.26	36.31	3.85	
8	213.6	17.47	1.66	
9	228.32	45.85	4	
10	243.51	20.33	1.61	
11	255.57	14.18	1.03	
12	264.39	9.33	.63	


SPECIMEN J61(250C)
SLOPE 59
INTERCEPT 93
J1C 100
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J61 (ALL DATA)


SPECIMEN J61

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     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

  SPECIMEN NUMBER                                    J61
  MATERIAL TYPE                                      A106B
  MATERIAL CONDITION                                 PARENT
  TEST TEMPERATURE(DEG C)                            250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          268.3
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        525.5
  CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
  SPECIMEN THICKNESS B(CM)                           3.175
  PERCENT SIDE GROOVE                                19.653
  SPECIMEN WIDTH W(CM)                               6.36600001
  YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
  EFFECTIVE MODULUS(Pa)                              1.98562875E+11

                FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           20.74
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.805

                CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                     3.898
  INITIAL A/W                                        .598
  AVERAGE CRACK EXTENSION 9PT(CM)                    .612
  DELTA A(CM) COMPLIANCE                             .612
  MAX DEVIATION OF SINGLE MEASUREMENT %              .82

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                      15
  LAST POINT                       19
  JIC(KN/M)                        100
  CORRELATION COEFF                .95
  SLOPE M(MPa)                     59
  INTERCEPT B (KN/M)               93

                VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD         YES
  LIGAMENT>25JIC/EFFECTIVE YIELD   YES
  DJ/DA<EFFECTIVE YIELD            YES

                QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                           NO
  CRACK SIZE DA<0.15*DELTA A                         YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    506.25
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  386.76
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.561
  25*JQ/EF.Y.(CM)                                    .63

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED          15
  LAST DATA POINT USED         28
  CONSTANT(C1)                 156.36
  EXPONENT(C2)                 .3465
```

J61(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
17.52	1.53	.01	1.54	1.54	1.62	3.82	1
24.26	2.93	.06	2.99	2.99	3.15	3.828	2
30.24	4.55	.67	5.22	5.22	5.48	3.823	3
36.15	6.51	1.62	8.12	8.13	8.5	3.827	4
40.99	8.37	3.57	11.94	11.91	12.45	3.793	5
46.7	10.86	5.81	16.67	16.69	17.31	3.817	6
51.54	13.23	9.23	22.45	22.49	23.22	3.824	7
54.17	14.61	16.03	30.64	30.49	31.55	3.784	8
58.06	16.79	22.27	39.06	38.99	40.09	3.795	9
61.3	18.71	30.06	48.77	48.82	49.89	3.805	10
64.05	20.42	39.42	59.84	59.93	61.06	3.807	11
65.82	21.57	50.98	72.55	72.43	73.86	3.797	12
68.91	23.64	60.68	84.32	84.92	85.7	3.824	13
70.69	24.88	73.19	98.07	98.77	99.51	3.828	14
72.11	25.89	86.85	112.74	113.85	114.21	3.839	15
73.52	26.91	101.28	128.19	130.11	129.67	3.857	16
76.16	28.88	112.91	141.79	146.1	143.26	3.902	17
76.73	29.32	130.04	159.35	164.36	160.8	3.914	18
77.23	29.7	146.86	176.56	183.28	177.93	3.939	19
79.85	31.75	157.29	189.03	201.24	190.33	4.009	20
80.19	32.02	174.24	206.26	220.89	207.46	4.038	21
80.78	32.49	189.61	222.09	240.56	223.17	4.078	22
80.51	32.27	205.77	238.04	262.01	238.89	4.13	23
82.45	33.85	214.98	248.83	280.71	249.6	4.198	24
83.34	34.58	228.45	263.03	300.12	263.7	4.24	25
82.53	33.91	242.97	276.88	322.02	277.27	4.299	26
83.09	34.37	254.25	288.62	341.38	288.88	4.351	27
83.89	35.04	262.83	297.86	360.91	298	4.417	28

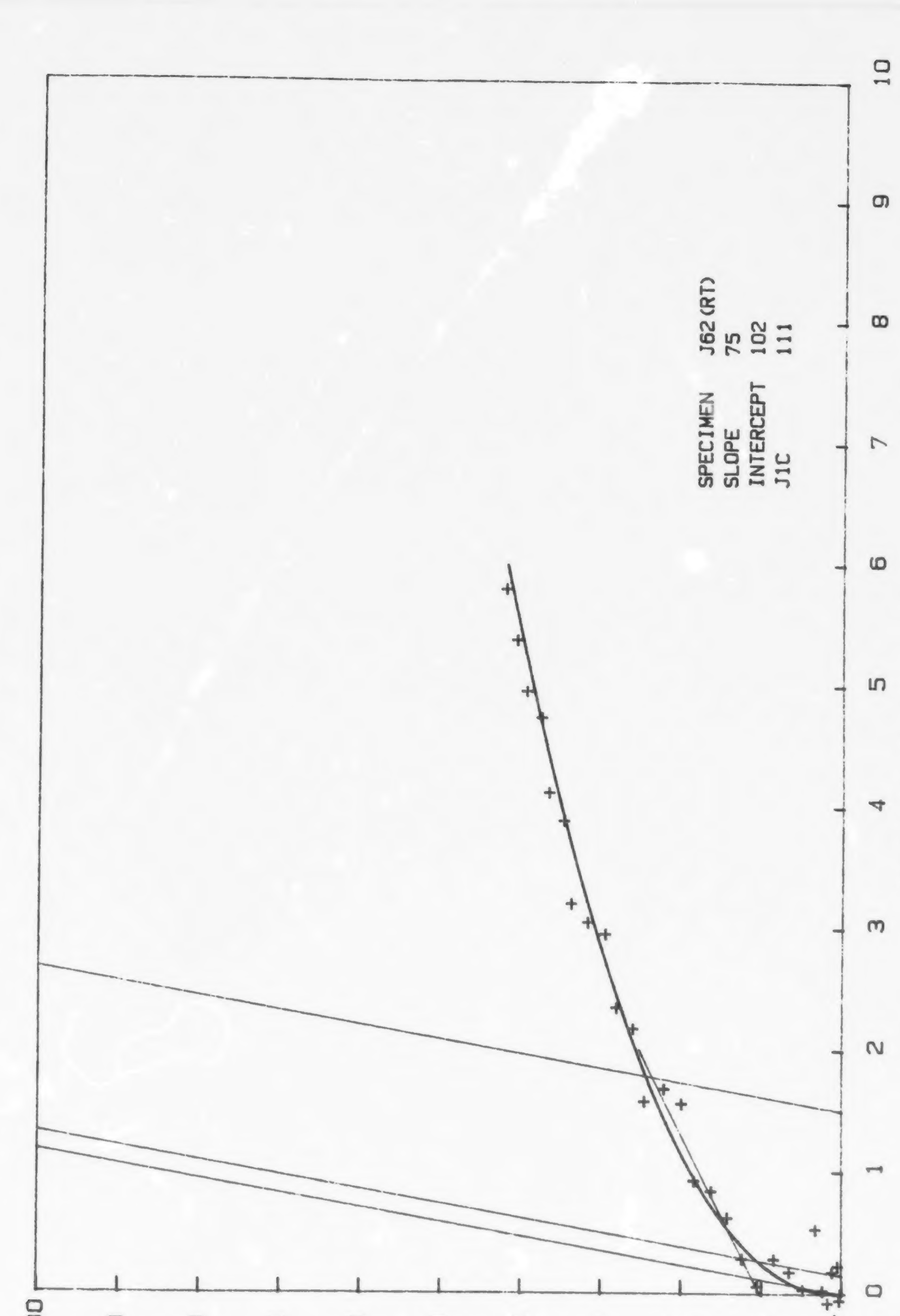
H(M)	D(M)	POISSON'S RATIO
.02394	2.54E-03	.3

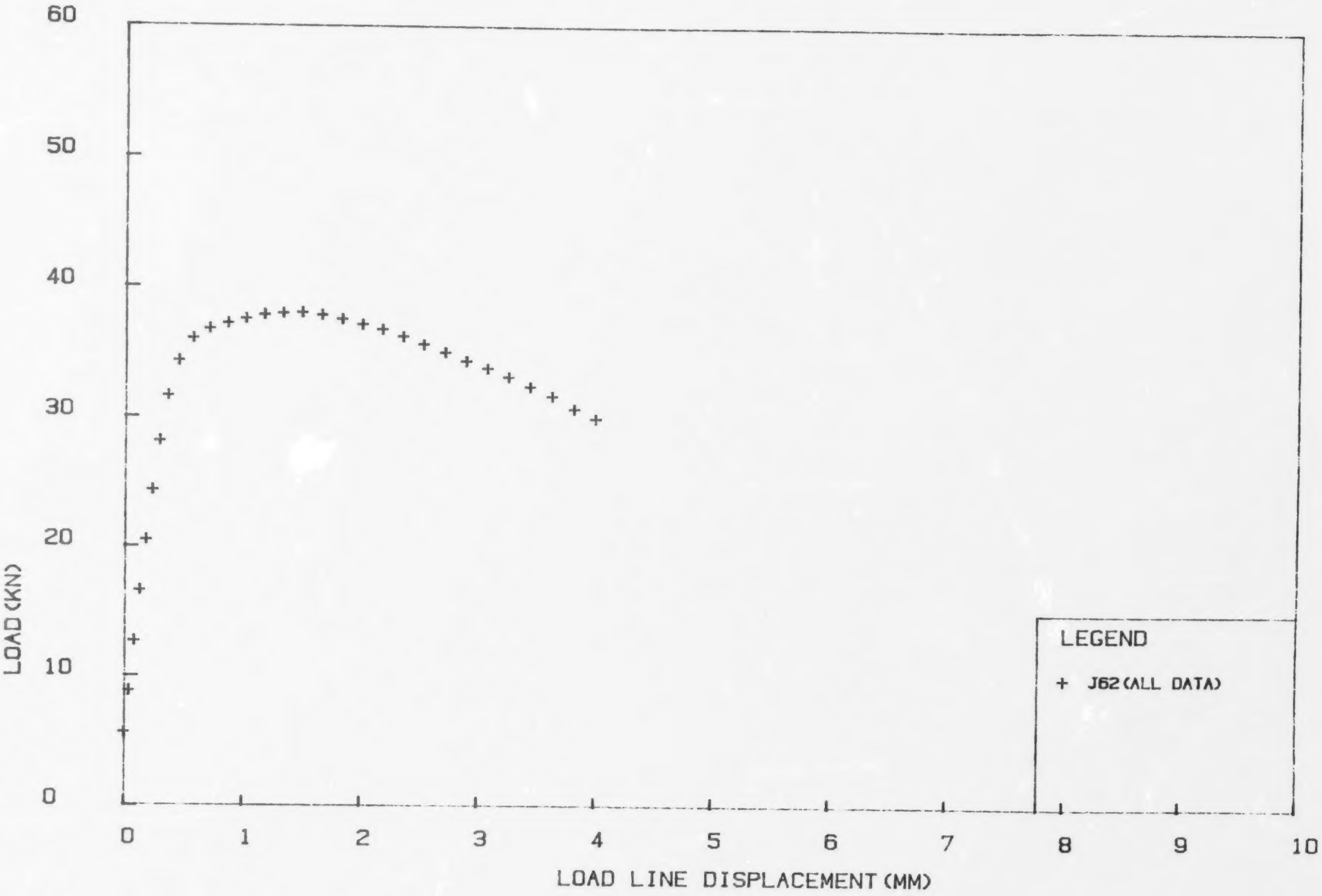
J61

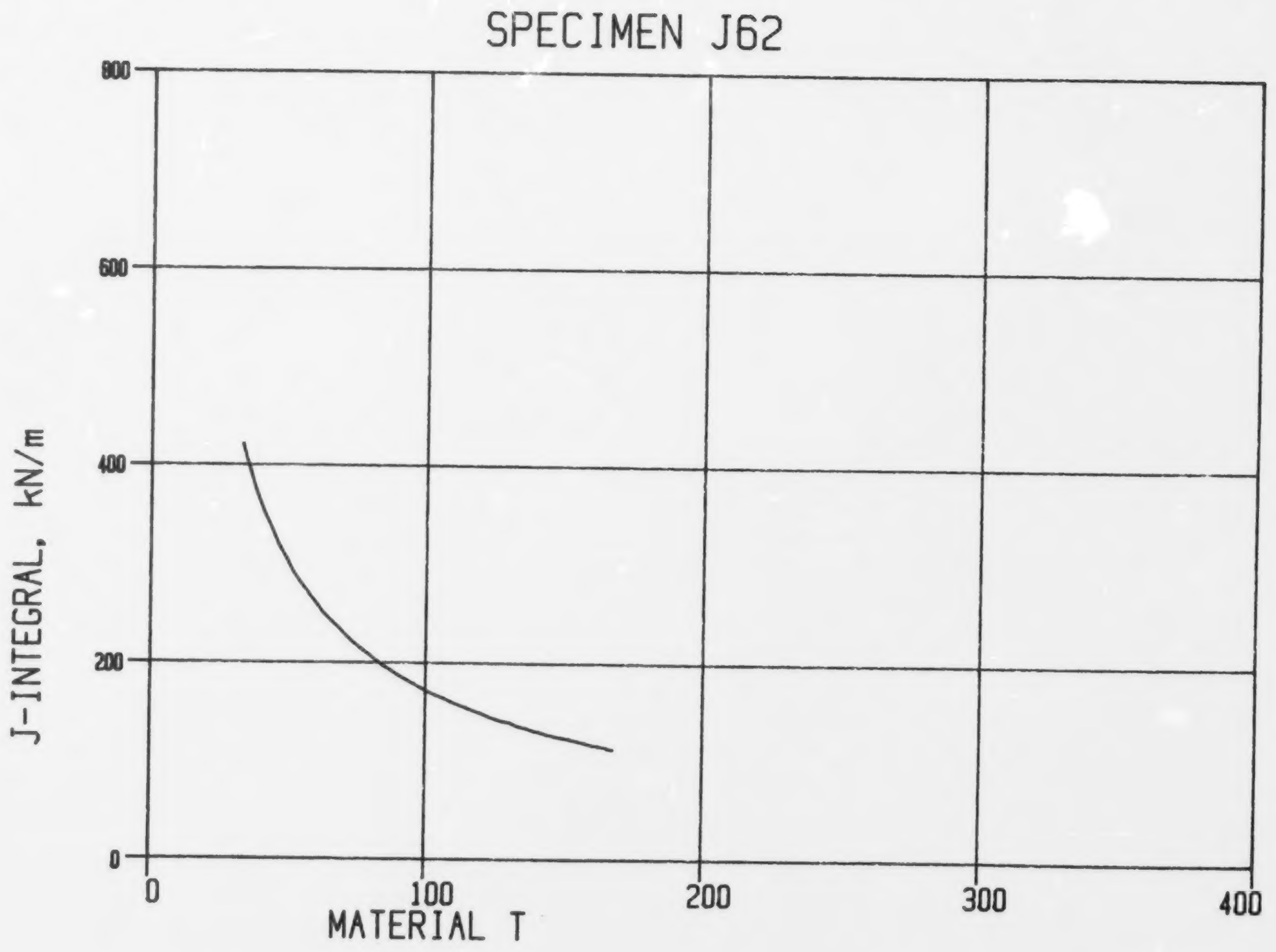
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.54	3.819	3.82	.145	.9982	1
2.99	3.827	3.828	.228	.9993	2
5.22	3.822	3.823	.18	.9991	3
8.12	3.826	3.827	.224	.9992	4
11.94	3.792	3.793	-.12	.9995	5
16.67	3.815	3.817	.12	.9996	6
22.45	3.822	3.824	.186	.9994	7
30.64	3.781	3.784	-.21	.9997	8
39.06	3.792	3.795	-.104	.9996	9
48.77	3.801	3.805	-2E-03	.9994	10
59.84	3.803	3.807	.024	.9989	11
72.55	3.792	3.797	-.08	.9991	12
84.32	3.819	3.824	.195	.9989	13
98.07	3.822	3.828	.228	.9998	14
112.74	3.832	3.839	.337	.9994	15
128.19	3.849	3.857	.518	.9999	16
141.79	3.895	3.902	.974	.9991	17
159.35	3.906	3.914	1.091	.9993	18
176.56	3.93	3.939	1.341	.9992	19
189.03	4	4.009	2.045	.9997	20
206.26	4.027	4.038	2.328	.9997	21
222.09	4.067	4.078	2.729	.9995	22
238.04	4.119	4.13	3.251	.9999	23
248.83	4.186	4.198	3.929	.9995	24
263.03	4.227	4.24	4.346	.9996	25
276.88	4.287	4.299	4.944	.9995	26
288.62	4.338	4.351	5.463	.9998	27
297.86	4.404	4.417	6.121	.9997	28

```
              LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J61
 1             6.47           0
 2             9.216          .032
 3            12.695          .073
 4            15.869          .121
 5            18.921          .172
 6            21.912          .226
 7            24.597          .291
 8            27.039          .359
 9            29.114          .439
 10           31.006          .526
 11           32.532          .62
 12           33.936          .72
 13           35.095          .826
 14           36.133          .935
 15           36.987          1.047
 16           37.476          1.168
 17           37.781          1.298
 18           38.025          1.428
 19           38.025          1.567
 20           37.659          1.714
 21           37.17           1.863
 22           36.621          2.014
 23           35.889          2.169
 24           34.485          2.343
 25           33.63           2.501
 26           32.959          2.659
 27           31.189          2.843
 28           30.151          3.009
 29           28.87           3.184
```

	J(KN/M)	T	W	J61
1	105.41	155.63	32.16	
2	120.47	99.53	17.87	
3	134.99	34.57	5.44	
4	150.57	173.88	24.4	
5	167.96	79.8	9.94	
6	182.79	20.58	2.29	
7	197.64	70.46	7.15	
8	214.18	45.85	4.22	
9	230.07	35.46	2.97	
10	243.43	18.44	1.42	
11	255.93	39.54	2.83	
12	269.96	26.89	1.77	
13	282.75	26.23	1.61	
14	293.24	16.3	.93	


SPECIMEN J62(RT)
SLOPE 75
INTERCEPT 102
J1C 111
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J62 (ALL DATA)


SPECIMEN J62
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                        J62
 MATERIAL TYPE                                          A106B
 MATERIAL CONDITION                                     PARENT
 TEST TEMPERATURE(DEG C)                                20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)              324
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)            529.5
 CRACK PLANE ORIENTATION (PER ASTM E399)                C-L
 SPECIMEN THICKNESS B(CM)                               3.16
 PERCENT SIDE GROOVE                                    18.987
 SPECIMEN WIDTH W(CM)                                   6.37
 YOUNGS MODULUS AT TEST TEMP(Pa)                        1.92346E+11
 EFFECTIVE MODULUS(Pa)                                  2.11116019E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                  12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM               21.31
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                    3.845

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                         3.934
 INITIAL A/W                                            .604
 AVERAGE CRACK EXTENSION 9PT(CM)                        .609
 DELTA A(CM) COMPLIANCE                                 .579
 MAX DEVIATION OF SINGLE MEASUREMENT %                  1.4

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                        13
 LAST POINT                         19
 JIC(KN/M)                          111
 CORRELATION COEFF                  .89
 SLOPE M(MPa)                       75
 INTERCEPT B (KN/M)                 102

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD           YES
 LIGAMENT>25JIC/EFFECTIVE YIELD     YES
 DJ/DA<EFFECTIVE YIELD              YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                               YES
 CRACK SIZE DA<0.15*DELTA A                             YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                        546.24
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                      415.12
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                       2.525
 25*JQ/EF.Y.(CM)                                        .65

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED          13
 LAST DATA POINT USED         30
 CONSTANT(C1)                 188.32
 EXPONENT(C2)                 .4485
```

J62(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
17.08	1.38	.04	1.42	1.42	1.5	3.845	1
24.42	2.82	.13	2.95	2.95	3.12	3.84	2
32.5	5	.09	5.08	5.09	5.36	3.868	3
39.06	7.22	1.25	8.47	8.47	8.91	3.824	4
47.52	10.68	1.44	12.13	12.15	12.74	3.863	5
54.04	13.82	3.73	17.55	17.55	18.37	3.838	6
61.11	17.67	6.49	24.16	24.18	25.19	3.848	7
68.43	22.16	10.97	33.13	33.32	34.32	3.898	8
69.64	22.94	25.88	48.82	48.73	50.22	3.849	9
71.7	24.32	41.58	65.9	66	67.33	3.863	10
73.01	25.22	59.59	84.81	85.14	86.24	3.874	11
72.7	25	80.44	105.45	105.08	106.98	3.851	12
74.35	26.15	98.15	124.3	124.88	125.79	3.874	13
76.18	27.45	115.14	142.59	144.87	144	3.907	14
77.39	28.33	133.94	162.27	165.88	163.63	3.929	15
77.43	28.37	155.45	183.82	188.03	185.14	3.938	16
80.07	30.33	169.41	199.74	209.17	200.91	4.001	17
79.8	30.13	191.47	221.6	232.13	222.68	4.013	18
78.47	29.13	216.79	245.92	255.37	247.01	4.003	19
80.5	30.66	229.98	260.64	277.14	261.59	4.063	20
80.08	30.34	251.11	281.44	300.12	282.28	4.08	21
82.11	31.9	263.49	295.38	322.49	296.09	4.14	22
81.1	31.12	286.36	317.48	346.06	318.06	4.15	23
80.67	30.79	307.29	338.08	369.14	338.56	4.165	24
83.12	32.68	314.79	347.48	390.52	347.91	4.233	25
82.71	32.37	334.13	366.5	413.87	366.78	4.257	26
84.75	33.98	342.27	376.25	435.84	376.48	4.318	27
83.55	33.02	362.42	395.45	459.58	395.49	4.34	28
84.33	33.65	374.21	407.86	481.34	407.79	4.383	29
83.52	33	388.82	421.82	505.09	421.53	4.424	30

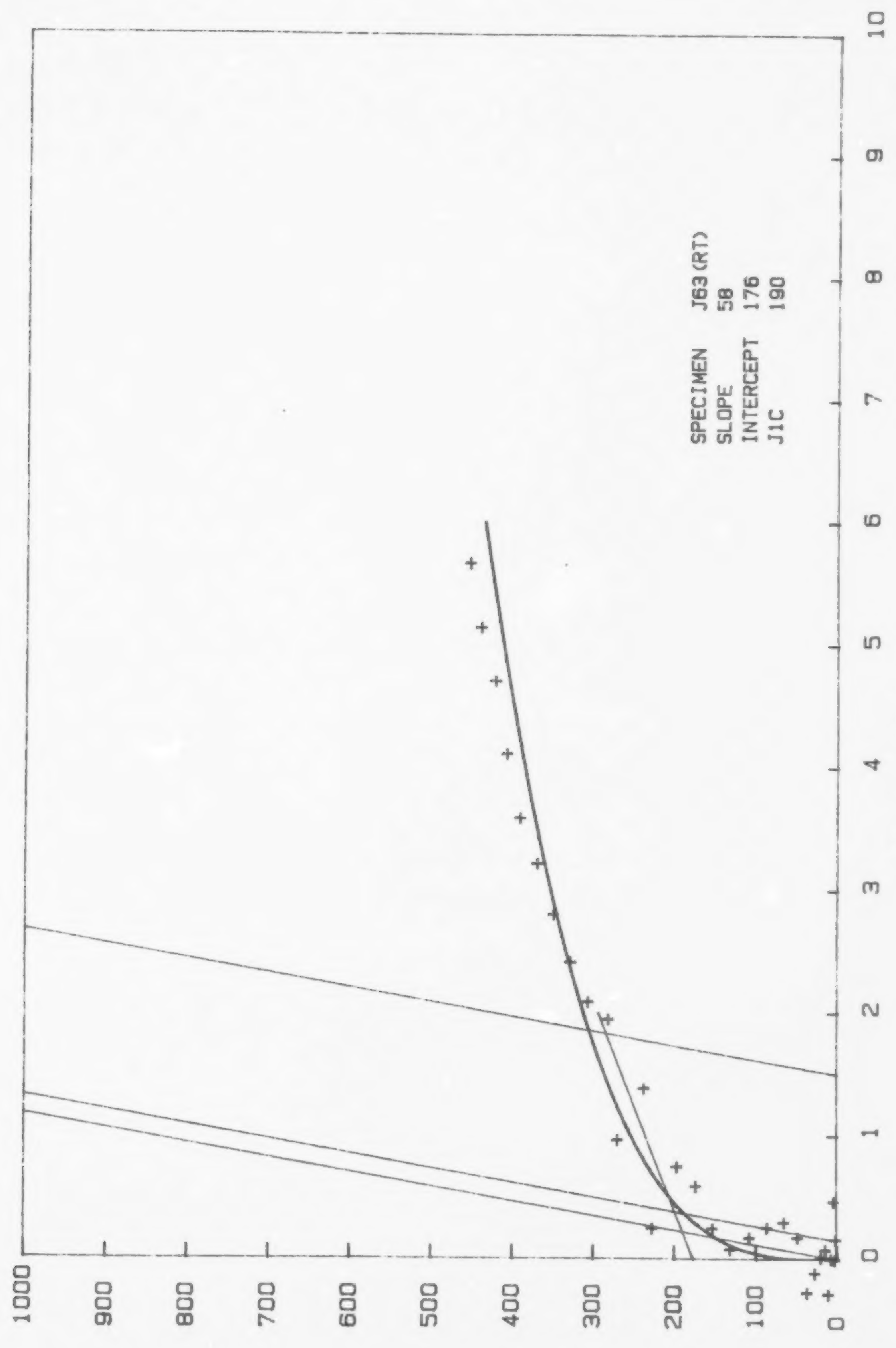
H(M)	D(M)	POISSON'S RATIO
.02386	2.54E-03	.3

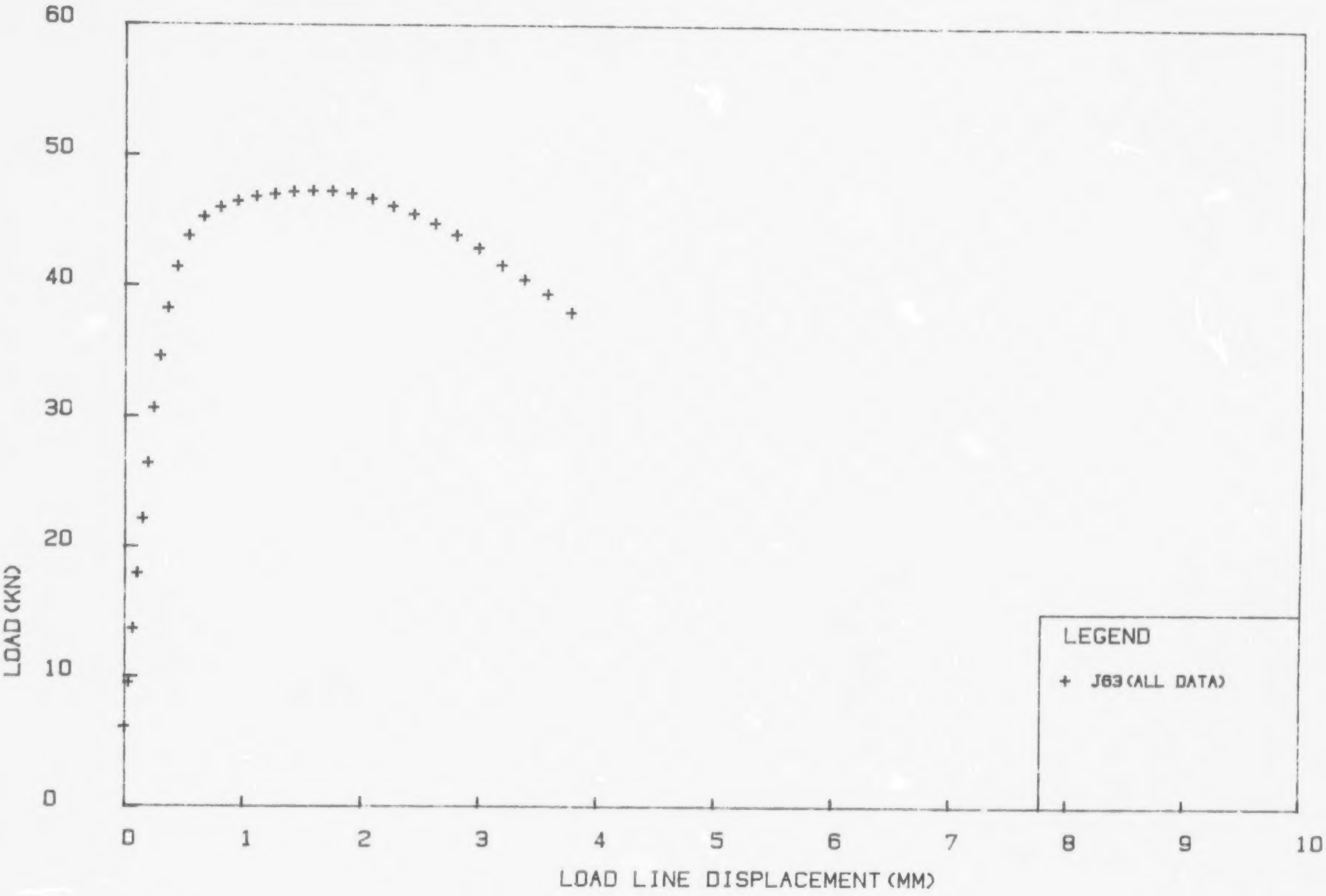
J62

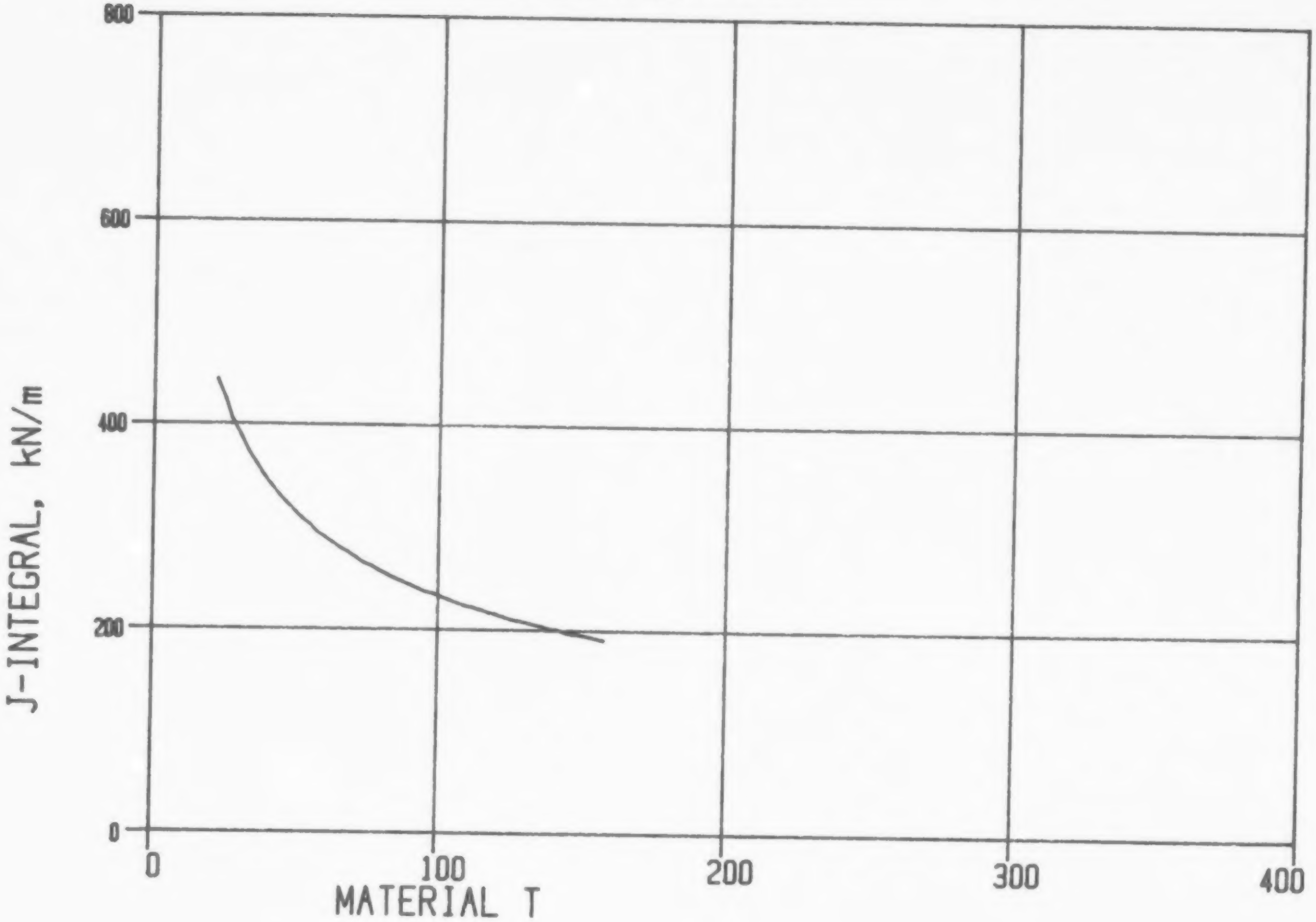
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.42	3.845	3.845	4E-03	.9981	1
2.95	3.84	3.84	-.05	.9977	2
5.08	3.867	3.868	.231	.9985	3
8.47	3.823	3.824	-.208	.9978	4
12.13	3.862	3.863	.181	.9983	5
17.55	3.836	3.838	-.073	.9977	6
24.16	3.846	3.848	.03	.9978	7
33.13	3.896	3.898	.532	.9992	8
48.82	3.846	3.849	.037	.9971	9
65.9	3.859	3.863	.182	.9986	10
84.81	3.869	3.874	.286	.9979	11
105.45	3.845	3.851	.062	.9984	12
124.3	3.867	3.874	.29	.9978	13
142.59	3.9	3.907	.623	.9993	14
162.27	3.921	3.929	.843	.9988	15
183.82	3.929	3.938	.927	.9974	16
199.74	3.991	4.001	1.56	.9984	17
221.6	4.003	4.013	1.681	.9993	18
245.92	3.991	4.003	1.577	.9977	19
260.64	4.051	4.063	2.177	.9985	20
281.44	4.067	4.08	2.348	.9982	21
295.38	4.127	4.14	2.952	.9992	22
317.48	4.136	4.15	3.051	.9991	23
338.08	4.15	4.165	3.202	.9995	24
347.48	4.218	4.233	3.883	.999	25
366.5	4.241	4.257	4.117	.9984	26
376.25	4.302	4.318	4.735	.9988	27
395.45	4.323	4.34	4.953	.9987	28
407.86	4.365	4.383	5.375	.9994	29
421.82	4.407	4.424	5.795	.9994	30

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J62
1	5.615	0	
2	8.85	.038	
3	12.695	.082	
4	16.602	.128	
5	20.508	.181	
6	24.353	.234	
7	28.137	.294	
8	31.616	.363	
9	34.302	.452	
10	36.011	.571	
11	36.743	.713	
12	37.17	.865	
13	37.537	1.017	
14	37.842	1.174	
15	37.964	1.333	
16	38.025	1.495	
17	37.842	1.663	
18	37.537	1.833	
19	37.109	2.006	
20	36.743	2.177	
21	36.194	2.354	
22	35.583	2.529	
23	34.973	2.712	
24	34.302	2.892	
25	33.752	3.071	
26	33.081	3.253	
27	32.349	3.438	
28	31.616	3.624	
29	30.64	3.813	
30	29.907	3.997	
31	28.625	4.198	

	J(KN/M)	T	W	J62
1	114.87	87.31	17.96	
2	133.44	58.04	10.14	
3	152.43	94.22	14.28	
4	173.05	270.26	35.97	
5	191.78	26.6	3.11	
6	210.67	190.32	20.16	
7	233.76	-247.33	-23.72	
8	253.28	25.89	2.23	
9	271.04	128.7	10.3	
10	288.41	24.37	1.78	
11	306.43	236.83	16.24	
12	327.78	143.71	9.15	
13	342.78	14.56	.86	
14	356.99	85.88	4.81	
15	371.37	16.69	.87	
16	385.85	92.8	4.62	
17	401.65	31.06	1.46	
18	414.84	35.14	1.56	


SPECIMEN J63(RT)
SLOPE 58
INTERCEPT 176
J1C 190
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J63 (ALL DATA)



SPECIMEN J63

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J63
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	324
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	529.5
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	3.15
PERCENT SIDE GROOVE	18.222
SPECIMEN WIDTH W(CM)	6.36
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.05788927E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	18.66
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.606

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.688
INITIAL A/W	.567
AVERAGE CRACK EXTENSION 9PT(CM)	.595
DELTA A(CM) COMPLIANCE	.566
MAX DEVIATION OF SINGLE MEASUREMENT %	.65

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	16
LAST POINT	23
JIC(KN/M)	190
CORRELATION COEFF	.74
SLOPE M(MPa)	58
INTERCEPT B (KN/M)	176

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	549.65
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	466.93
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.754
25*JQ/EF.Y.(CM)	1.113

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	16
LAST DATA POINT USED	30
CONSTANT(C1)	253.77
EXPONENT(C2)	.3032

```
        J63(RT)

 K         J-ELASTIC     J-PLASTIC    JEL+JPL     J(M)       J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)         (KN/M)       (KN/M)    (KN/M)         (KN/M)       (CM)

 16.13      1.23          .01          1.25       1.25        1.28      3.622  1
 22.95      2.49          .1           2.59       2.59        2.69      3.605  2
 30.94      4.53          -.24         4.29       4.3         4.46      3.653  3
 37.21      6.55          .68          7.23       7.24        7.51      3.606  4
 43.67      9.02          1.68         10.71      10.71       11.11     3.577  5
 51.67      12.63         1.9          14.53      14.56       15.07     3.613  6
 58.15      16            3.96         19.95      19.98       20.64     3.607  7
 63.85      19.29         8.09         27.37      27.37       28.21     3.594  8
 68.53      22.22         15.04        37.26      37.19       38.24     3.579  9
 74.32      26.13         22.88        49.01      49.27       50.09     3.623  10
 77.35      28.31         37.57        65.88      66.27       67.02     3.636  11
 78.4       29.08         57.43        86.5       86.82       87.69     3.631  12
 78.86      29.43         78.9         108.33     108.42      109.56    3.623  13
 79.06      29.57         101.99       131.56     131.28      132.84    3.614  14
 80.13      30.38         123.02       153.39     153.95      154.65    3.631  15
 82.05      31.85         142.28       174.13     176.75      175.32    3.665  16
 82.93      32.53         164.8        197.34     201.07      198.5     3.681  17
 80.55      30.7          196.69       227.39     227.03      228.74    3.631  18
 85.75      34.79         203.4        238.18     248.69      239.53    3.744  19
 82.88      32.5          237.86       270.36     276.58      271.87    3.702  20
 86.89      35.72         246.75       282.47     300.3       283.91    3.801  21
 86.48      35.38         272.16       307.54     327.13      308.9     3.815  22
 86.8       35.65         293.98       329.63     353.7       330.84    3.847  23
 87.25      36.02         314.26       350.27     380.25      351.34    3.886  24
 87.6       36.31         334.35       370.66     407.42      371.55    3.927  25
 86.95      35.77         356.19       391.96     435.33      392.64    3.964  26
 87.64      36.34         372.05       408.39     461.7       408.91    4.016  27
 88.81      37.31         385.7        423.01     488.42      423.4     4.076  28
 88.3       36.89         404          440.89     515.67      441.06    4.119  29
 88.88      37.38         417.09       454.47     541.22      454.52    4.172  30

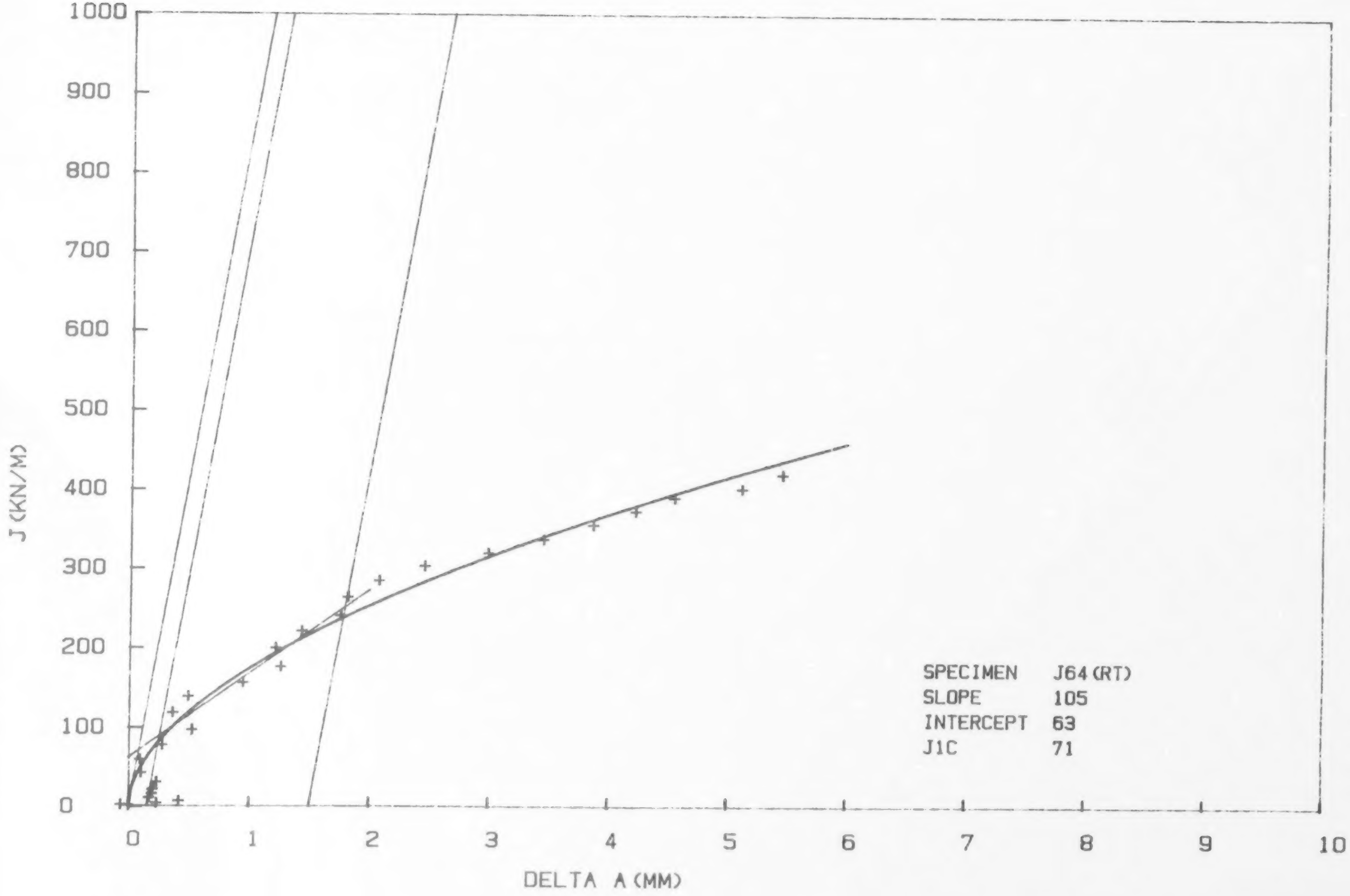
H(M)             D(M)            POISSON'S RATIO
.02386           2.54E-03        .3
```

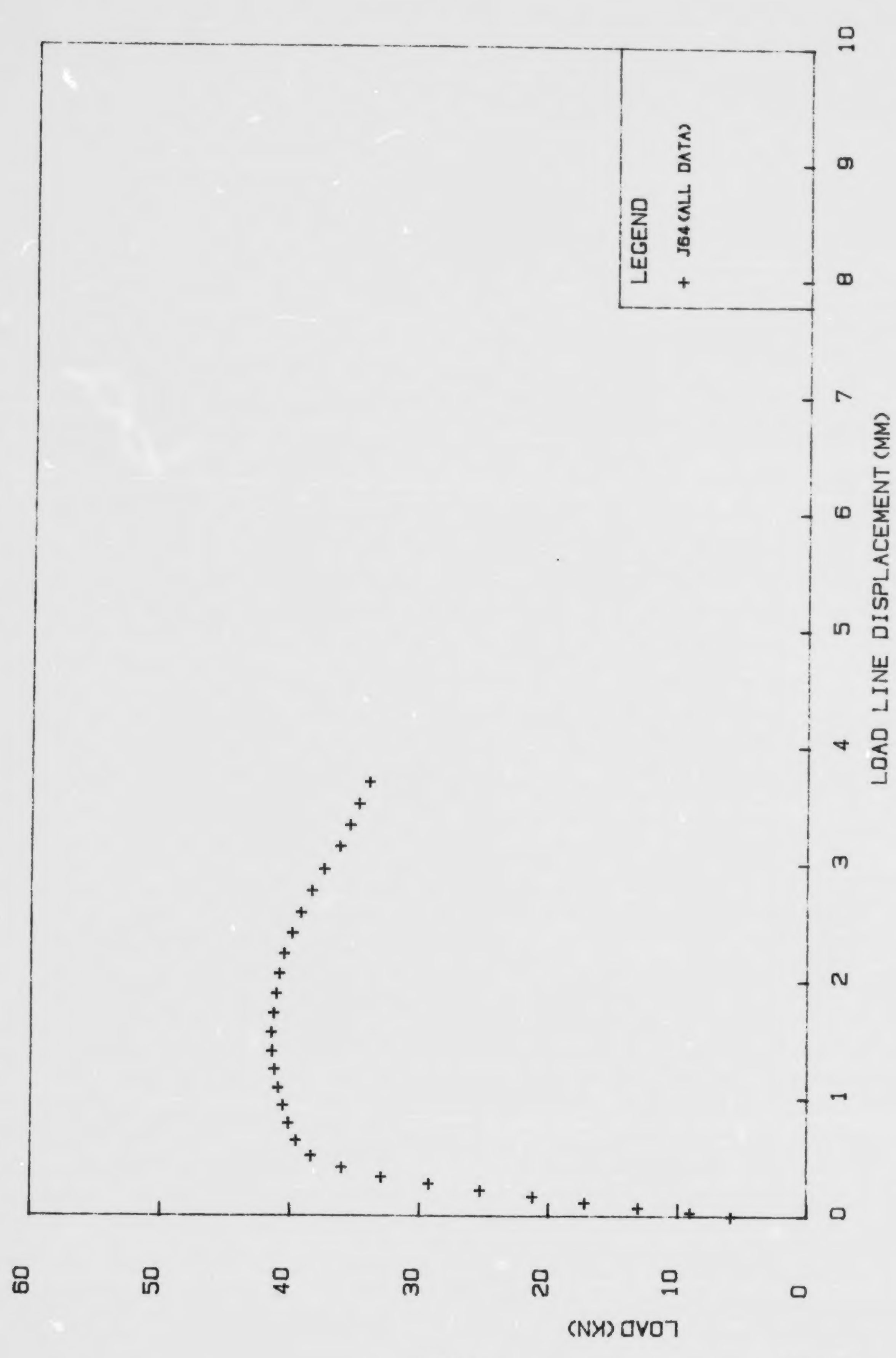
J63

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.25	3.622	3.622	.157	.995	1
2.59	3.605	3.605	-5E-03	.9969	2
4.29	3.652	3.653	.466	.9978	3
7.23	3.605	3.606	2E-03	.9975	4
10.71	3.576	3.577	-.286	.9966	5
14.53	3.612	3.613	.074	.9969	6
19.95	3.605	3.607	.01	.998	7
27.37	3.592	3.594	-.115	.9962	8
37.26	3.576	3.579	-.274	.9958	9
49.01	3.62	3.623	.175	.998	10
65.88	3.632	3.636	.298	.9983	11
86.5	3.626	3.631	.253	.9978	12
108.33	3.617	3.623	.172	.9987	13
131.56	3.607	3.614	.077	.9969	14
153.39	3.623	3.631	.246	.998	15
174.13	3.656	3.665	.591	.9977	16
197.34	3.671	3.681	.751	.9973	17
227.39	3.62	3.631	.247	.9985	18
238.18	3.733	3.744	1.384	.9971	19
270.36	3.69	3.702	.964	.997	20
282.47	3.788	3.801	1.949	.998	21
307.54	3.8	3.815	2.088	.9962	22
329.63	3.832	3.847	2.41	.9986	23
350.27	3.87	3.886	2.798	.9971	24
370.66	3.91	3.927	3.21	.9987	25
391.96	3.947	3.964	3.582	.9972	26
408.39	3.998	4.016	4.103	.9966	27
423.01	4.057	4.076	4.697	.9972	28
440.89	4.1	4.119	5.134	.9979	29
454.47	4.152	4.172	5.657	.9977	30

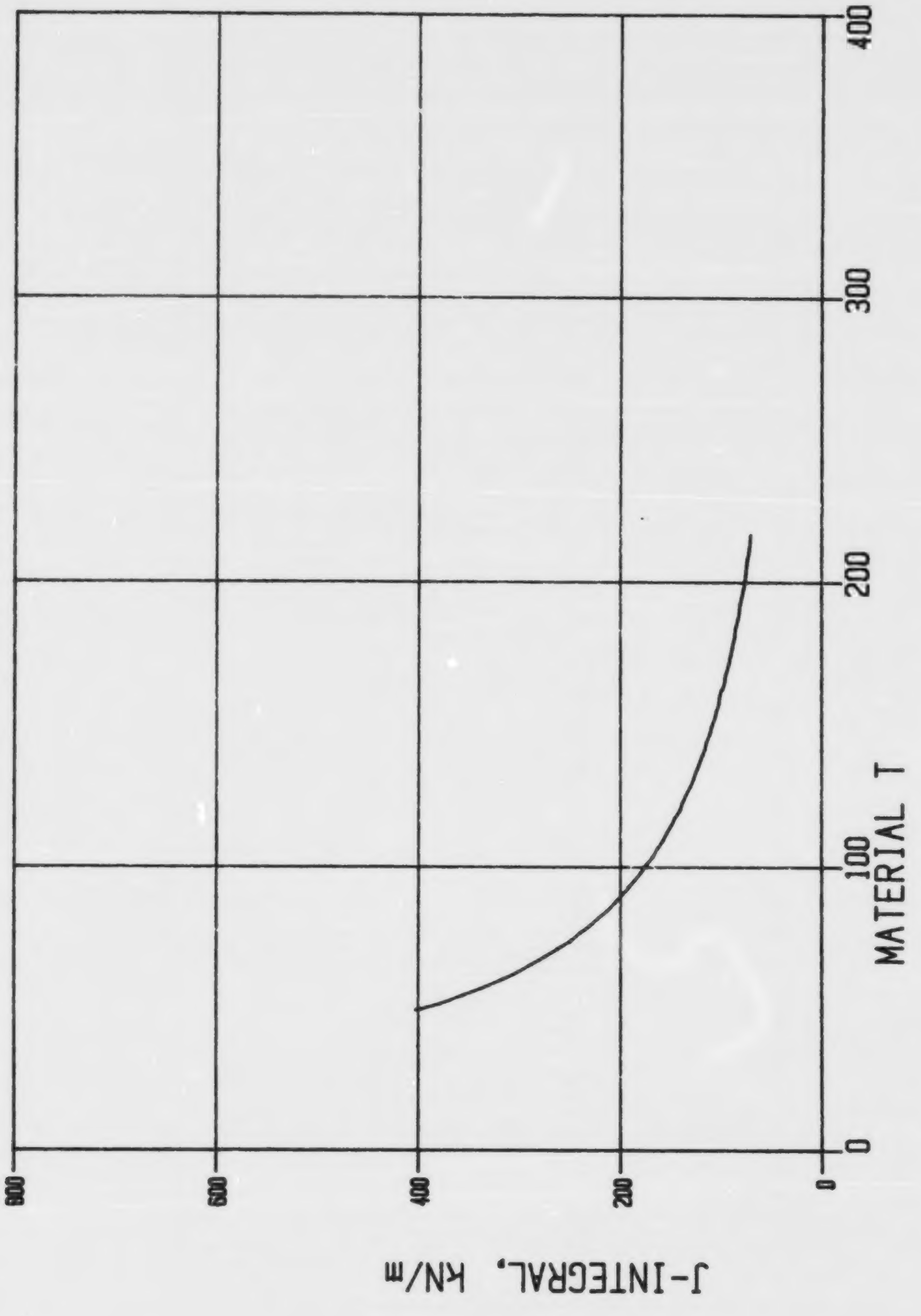
	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J63
1	6.104	0	
2	9.521	.032	
3	13.672	.07	
4	17.944	.107	
5	22.156	.153	
6	26.428	.198	
7	30.64	.245	
8	34.607	.299	
9	38.269	.364	
10	41.443	.442	
11	43.823	.54	
12	45.288	.663	
13	46.021	.804	
14	46.509	.951	
15	46.875	1.105	
16	47.058	1.261	
17	47.241	1.42	
18	47.302	1.583	
19	47.302	1.746	
20	47.119	1.912	
21	46.692	2.085	
22	46.143	2.262	
23	45.532	2.439	
24	44.8	2.62	
25	43.945	2.803	
26	42.969	2.992	
27	41.626	3.187	
28	40.527	3.379	
29	39.429	3.577	
30	38.025	3.776	
31	36.865	3.969	

	J(KN/M)	T	W	J63
1	185.73	153.28	20.93	
2	212.36	-63	-7.67	
3	232.79	10.03	1.07	
4	254.27	-80.91	-8.01	
5	276.41	12.98	1.14	
6	295	189.89	15.51	
7	318.58	72.51	5.42	
8	339.95	56.23	3.87	
9	360.46	52.15	3.33	
10	381.31	60.47	3.6	
11	400.17	33.36	1.85	
12	415.7	25.97	1.35	
13	431.95	43.27	2.13	
14	447.68	27.41	1.27	


J (KN/M)
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)
SPECIMEN J64 (RT)
SLOPE 105
INTERCEPT 63
J1C 71


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J64 (ALL DATA)

SPECIMEN J64



```
      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

  SPECIMEN NUMBER                                    J64
  MATERIAL TYPE                                      A106B
  MATERIAL CONDITION                                 PARENT
  TEST TEMPERATURE(DEG C)                            20
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          324
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        529.5
  CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
  SPECIMEN THICKNESS B(CM)                           3.175
  PERCENT SIDE GROOVE                                19.527
  SPECIMEN WIDTH W(CM)                               6.36
  YOUNGS MODULUS AT TEST TEMP(Pa)                    1.92346E+11
  EFFECTIVE MODULUS(Pa)                              2.14427804E+11

                 FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           19.8
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.723

                 CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                     3.832
  INITIAL A/W                                        .585
  AVERAGE CRACK EXTENSION 9PT(CM)                    .556
  DELTA A(CM) COMPLIANCE                             .545
  MAX DEVIATION OF SINGLE MEASUREMENT %              1.4

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                    11
  LAST POINT                     20
  JIC(KN/M)                      71
  CORRELATION COEFF              .94
  SLOPE M(MPa)                   105
  INTERCEPT B (KN/M)             63

                 VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD       YES
  LIGAMENT>25JIC/EFFECTIVE YIELD YES
  DJ/DA<EFFECTIVE YIELD          YES

                 QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                           YES
  CRACK SIZE DA<0.15*DELTA A                         YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    545.17
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  446.31
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.637
  25*JQ/EF.Y.(CM)                                    .416

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED        11
  LAST DATA POINT USED       29
  CONSTANT(C1)               174.76
  EXPONENT(C2)               .5418
```

```
             J64(RT)

K          J-ELASTIC      J-PLASTIC      JEL+JPL       J(M)        J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)          (KN/M)         (KN/M)      (KN/M)          (KN/M)       (CM)

16.23       1.25            .05            1.29         1.29          1.36     3.723  1
23.38       2.59            .06            2.64         2.64          2.79     3.716  2
31.37       4.65           0               4.66         4.66          4.9      3.746  3
39.14       7.25            .39            7.64         7.64          8.02     3.765  4
45.98      10              1.59           11.6         11.59         12.15     3.74   5
53.27      13.42           2.92           16.35        16.34         17.09     3.743  6
59.94      17              5.31           22.31        22.3          23.26     3.743  7
65.62      20.37          10.76           31.13        31.14         32.26     3.746  8
69.41      22.8           20.35           43.15        43.09         44.45     3.733  9
71.47      24.17          35.89           60.06        59.99         61.44     3.732  10
73.38      25.48          52.94           78.41        78.68         79.8      3.751  11
75.27      26.81          70.69           97.5         98.42         98.86     3.776  12
75.22      26.77          92.15          118.91       119.25        120.34     3.759  13
76.36      27.59         111.66          139.25       140.18        140.67     3.772  14
78.86      29.42         127.44          156.86       160.37        158.22     3.818  15
80.54      30.69         146.22          176.9        182.46        178.19     3.849  16
79.96      30.25         170.41          200.66       205.88        201.94     3.845  17
80.69      30.81         191.07          221.87       229.01        223.09     3.866  18
81.89      31.73         209.95          241.68       252.06        242.8      3.899  19
81.46      31.39         233.72          265.12       276.13        266.19     3.905  20
81.59      31.5          254.72          286.22       300.44        287.17     3.931  21
82.24      32            272.7           304.7        324.08        305.52     3.969  22
83.36      32.88         288.39          321.27       348.44        321.93     4.022  23
83.99      33.37         305.1           338.47       372.93        338.97     4.068  24
83.65      33.1          323.85          356.95       398.48        357.24     4.11   25
83.91      33.31         341.07          374.38       422.41        374.53     4.146  26
84.28      33.6          358.14          391.74       446.09        391.76     4.178  27
85.86      34.88         368.43          403.31       469.34        403.27     4.234  28
84.76      33.99         387.37          421.36       494.76        421.09     4.268  29

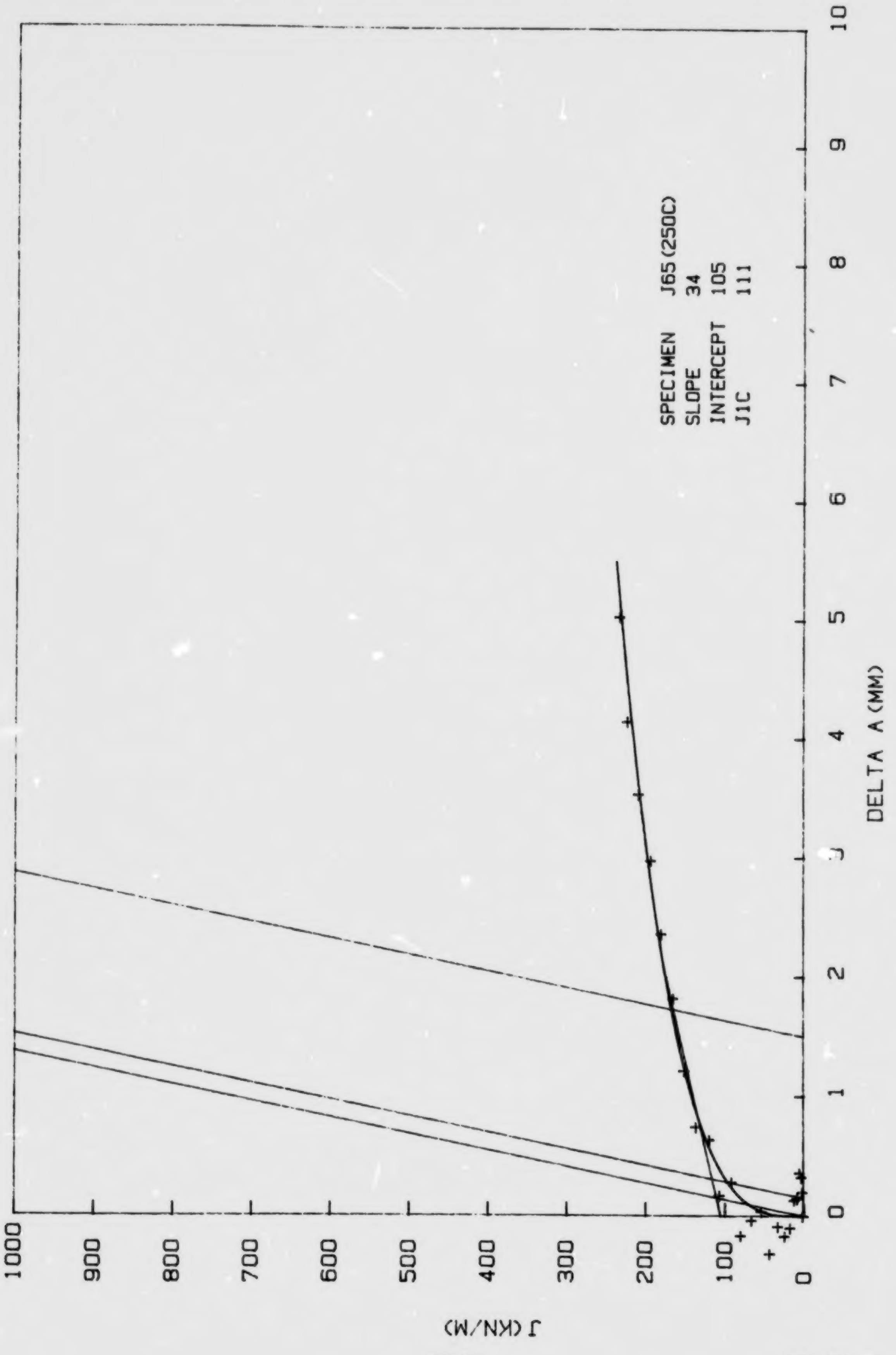
H(M)             D(M)            POISSON'S RATIO
.02386           2.54E-03        .3
```

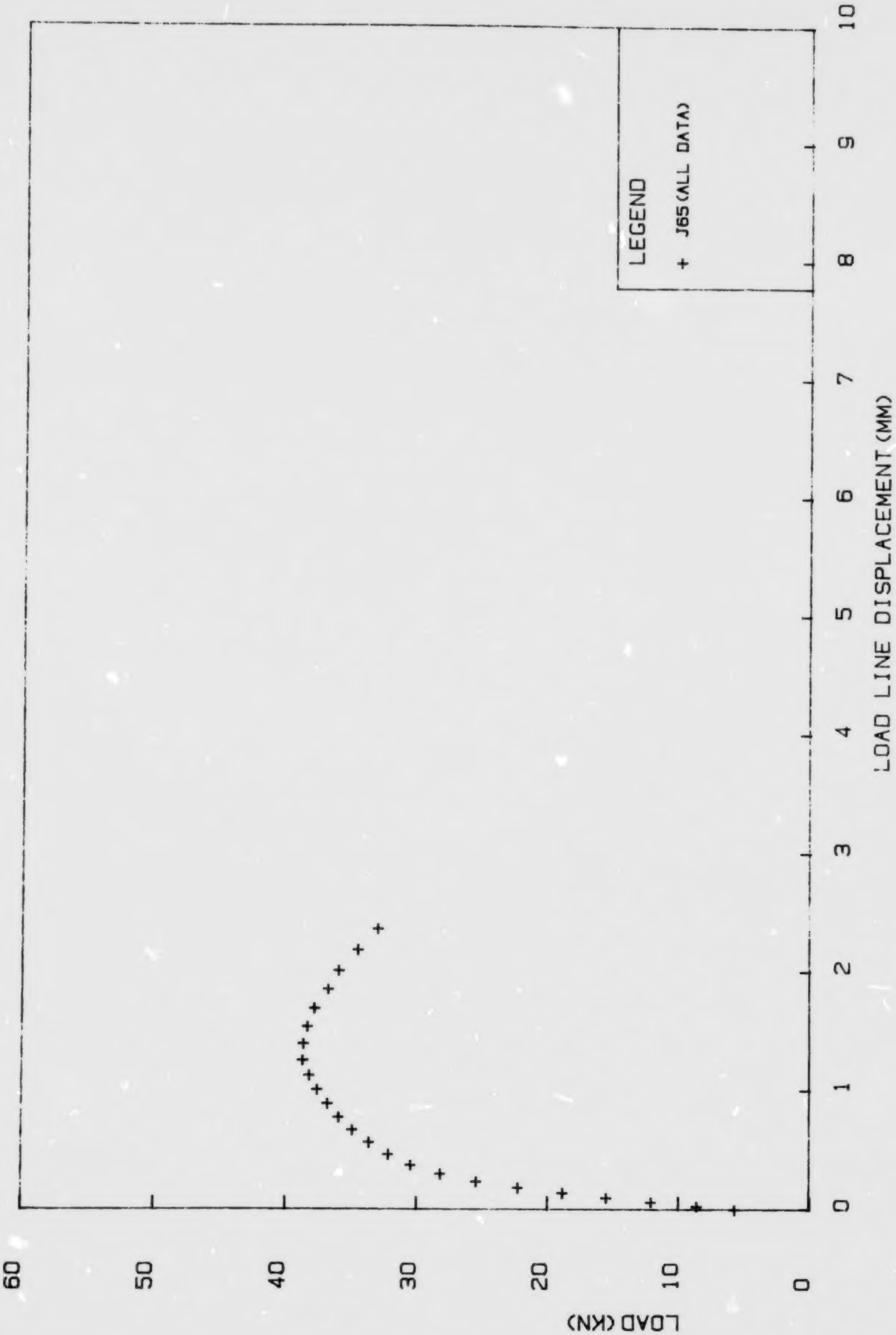
J64

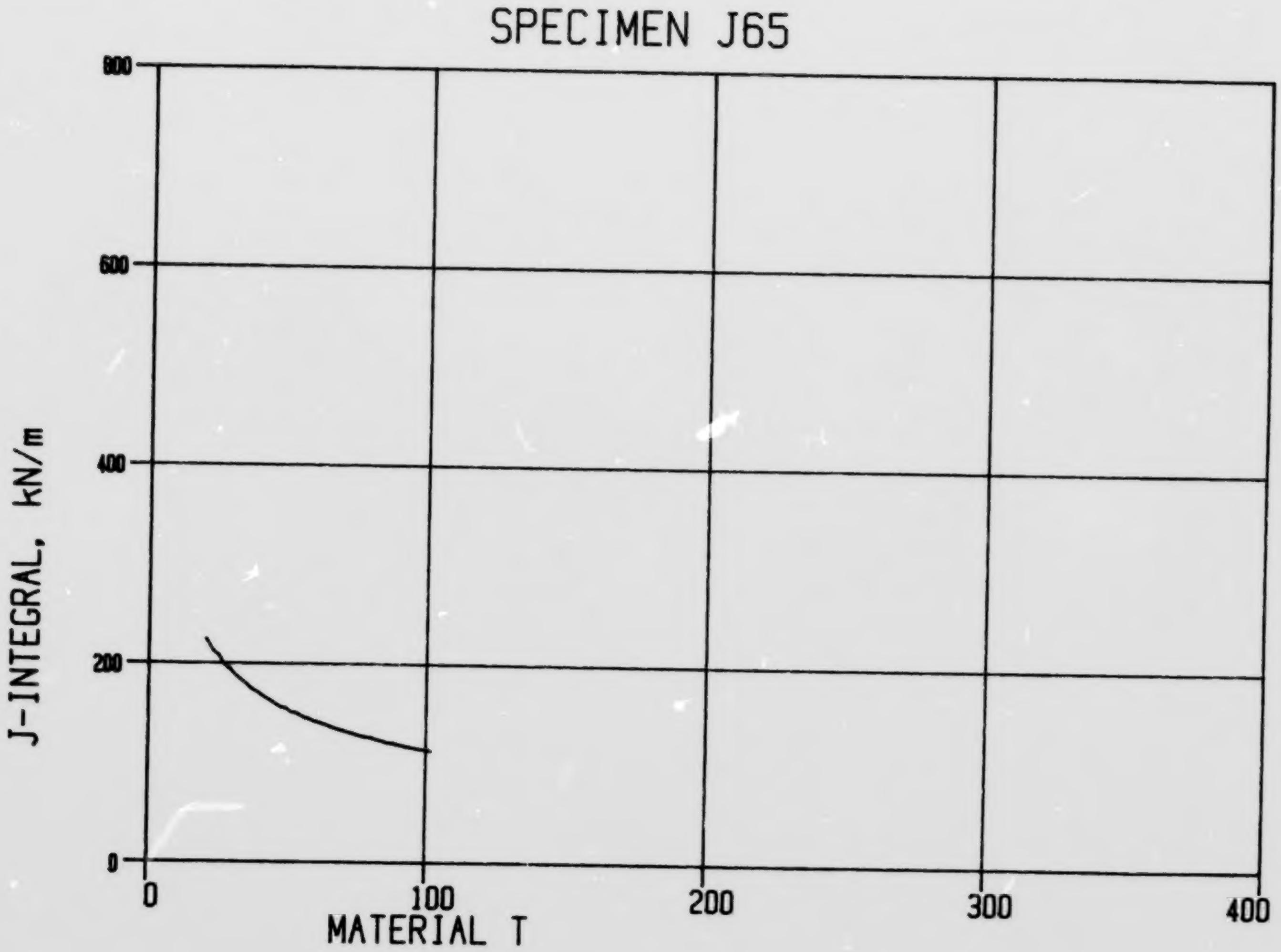
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.29	3.723	3.723	0	.9974	1
2.64	3.716	3.716	-.065	.9991	2
4.66	3.746	3.746	.234	.9983	3
7.64	3.764	3.765	.419	.9991	4
11.6	3.739	3.74	.17	.9985	5
16.35	3.741	3.743	.196	.9986	6
22.31	3.741	3.743	.199	.9991	7
31.13	3.744	3.746	.233	.999	8
43.15	3.73	3.733	.103	.9995	9
60.06	3.729	3.732	.093	.9995	10
78.41	3.746	3.751	.28	.9987	11
97.5	3.77	3.776	.526	.998	12
118.91	3.753	3.759	.364	.9984	13
139.25	3.765	3.772	.491	.9991	14
156.86	3.81	3.818	.947	.999	15
176.9	3.84	3.849	1.261	.9985	16
200.66	3.835	3.845	1.217	.9988	17
221.87	3.856	3.866	1.434	.9991	18
241.68	3.888	3.899	1.76	.9993	19
265.12	3.892	3.905	1.817	.9994	20
286.22	3.918	3.931	2.079	.999	21
304.7	3.955	3.969	2.459	.9995	22
321.27	4.007	4.022	2.991	.9988	23
338.47	4.053	4.068	3.453	.9991	24
356.95	4.094	4.11	3.869	.9989	25
374.38	4.129	4.146	4.225	.9992	26
391.74	4.161	4.178	4.55	.9995	27
403.31	4.217	4.234	5.115	.9997	28
421.36	4.25	4.268	5.453	.9994	29

```
              LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J64
    1          5.859         0
    2          9.033          .034
    3         13.062          .073
    4         17.212          .117
    5         21.24           .167
    6         25.33           .219
    7         29.297          .273
    8         32.959          .333
    9         36.011          .413
    10        38.391          .509
    11        39.551          .641
    12        40.161          .786
    13        40.588          .938
    14        40.955         1.088
    15        41.26          1.243
    16        41.443         1.396
    17        41.504         1.559
    18        41.321         1.722
    19        41.138         1.89
    20        40.894         2.058
    21        40.527         2.228
    22        39.917         2.405
    23        39.246         2.581
    24        38.391         2.766
    25        37.476         2.952
    26        36.255         3.146
    27        35.461         3.329
    28        34.79          3.511
    29        33.997         3.698
    30        32.715         3.895
```

	J(KN/M)	T	W	J64
1	69.24	103.91	37.07	
2	87.96	81.86	22.77	
3	108.21	-140.15	-31.89	
4	129.08	169.48	32.17	
5	148.06	40.85	6.64	
6	166.88	67.28	9.58	
7	188.78	-571.62	-72.11	
8	211.27	103.46	11.56	
9	231.78	64.17	6.45	
10	253.4	430.21	39.47	
11	275.67	85.33	7.12	
12	295.46	51.32	3.93	
13	312.98	32.87	2.32	
14	329.87	39.35	2.59	
15	347.71	46.88	2.87	
16	365.67	51.76	2.97	
17	383.06	56.43	3.04	
18	397.52	21.64	1.1	
19	412.33	56.27	2.7	


SPECIMEN J65(250C)
SLOPE 34
INTERCEPT 105
J1C 111
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J65 (ALL DATA)


SPECIMEN J65
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

```
     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                    J65
 MATERIAL TYPE                                      A106B
 MATERIAL CONDITION                                 PARENT
 TEST TEMPERATURE(DEG C)                            250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          224
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        506
 CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
 SPECIMEN THICKNESS B(CM)                           3.16
 PERCENT SIDE GROOVE                                18.892
 SPECIMEN WIDTH W(CM)                               6.36
 YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
 EFFECTIVE MODULUS(Pa)                              2.00358534E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           18.93
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.637

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                     3.73
 INITIAL A/W                                        .572
 AVERAGE CRACK EXTENSION 9PT(CM)                    .553
 DELTA A(CM) COMPLIANCE                             .503
 MAX DEVIATION OF SINGLE MEASUREMENT %              1.1

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     16
 LAST POINT                      19
 JIC(KN/M)                       111
 CORRELATION COEFF               .9
 SLOPE M(MPa)                    34
 INTERCEPT B (KN/M)              105

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD  YES
 DJ/DA<EFFECTIVE YIELD           YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                           YES
 CRACK SIZE DA<0.15*DELTA A                         YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    467.75
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  405.2
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.723
 25*JQ/EF.Y.(CM)                                    .76

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        16
 LAST DATA POINT USED       24
 CONSTANT(C1)               142.4
 EXPONENT(C2)               .3038
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          J65(250C)

K          J-ELASTIC       J-PLASTIC     JEL+JPL       J(M)          J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)          (KN/M)         (KN/M)     (KN/M)             (KN/M)       (CM)

14.72      1.08             0              1.08        1.08           1.13     3.637  1
20.91      2.18             0              2.18        2.18           2.28     3.657  2
27.02      3.63             .02            3.65        3.65           3.82     3.669  3
32.94      5.4              .38            5.78        5.78           6.04     3.673  4
38.42      7.35             1.25           8.6         8.6            8.96     3.651  5
43.86      9.58             2.84           12.42       12.41          12.89    3.65   6
47.96      11.45            6.51           17.96       17.93          18.54    3.627  7
51.6       13.25            11.64          24.89       24.83          25.56    3.62   8
54.75      14.92            18.61          33.53       33.51          34.27    3.628  9
56.51      15.9             28.37          44.27       44.05          45.09    3.605  10
59.85      17.83            36.79          54.62       54.89          55.48    3.641  11
61.37      18.75            48.34          67.09       67.22          68       3.633  12
62.37      19.37            61.31          80.68       80.51          81.65    3.62   13
65.37      21.28            71.14          92.41       93.57          93.38    3.665  14
66         21.68            85.87          107.55      108.31         108.57   3.654  15
68.67      23.48            96.89          120.37      123.09         121.38   3.7    16
69         23.71            113.31         137.01      140.25         138      3.711  17
70.39      24.67            127.05         151.72      157.59         152.62   3.758  18
71.99      25.8             140.04         165.84      175.6          166.64   3.819  19
72.42      26.11            155.2          181.32      194.96         181.95   3.873  20
73.72      27.05            167.68         194.74      213.37         195.26   3.934  21
73.35      26.79            183.48         210.27      233.87         210.57   3.99   22
73.07      26.58            197.92         224.5       254.19         224.59   4.051  23
73.12      26.62            207.87         234.49      273.84         234.37   4.14   24

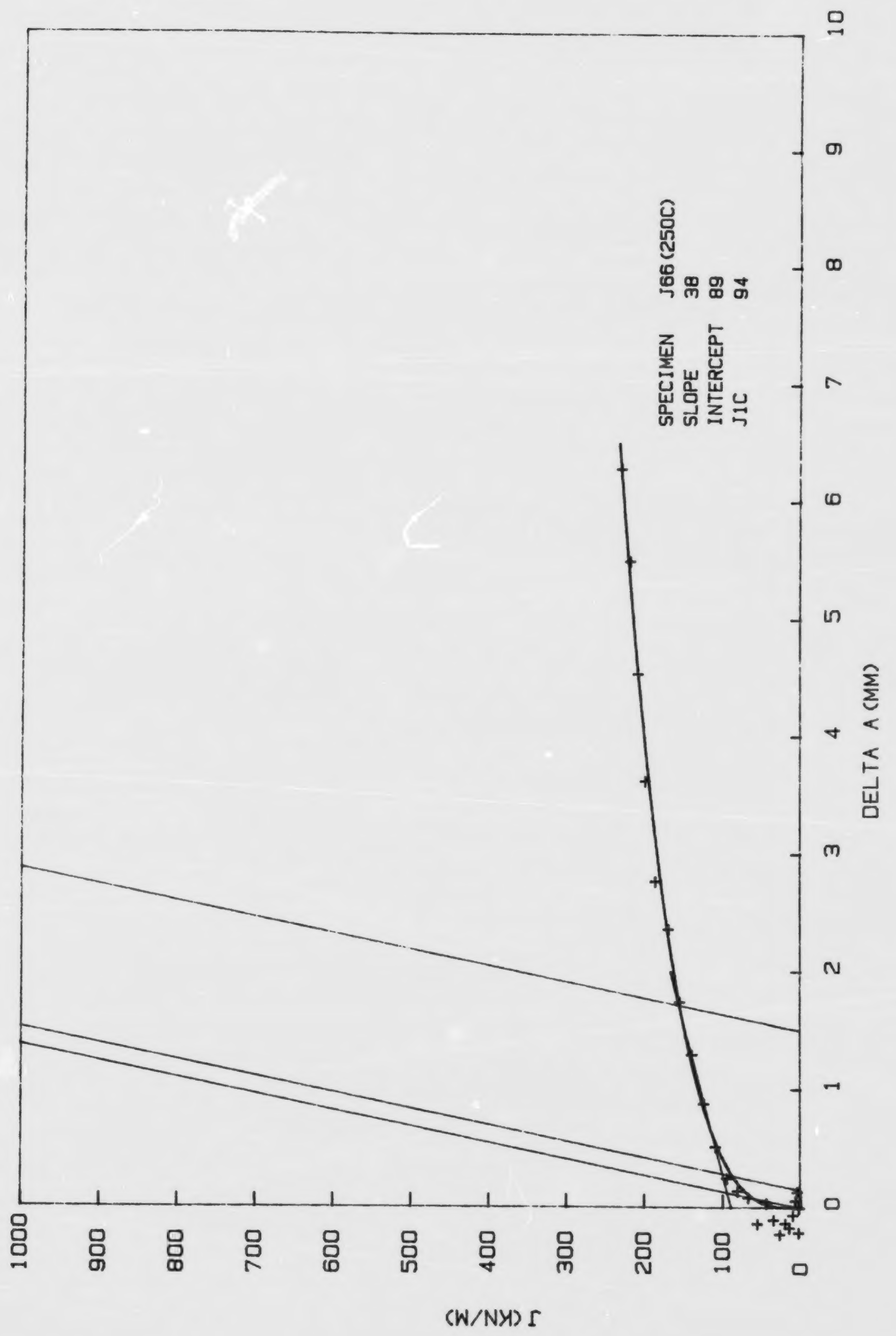
H(M)            D(M)            POISSON'S RATIO
.02386          2.54E-03        .3
```

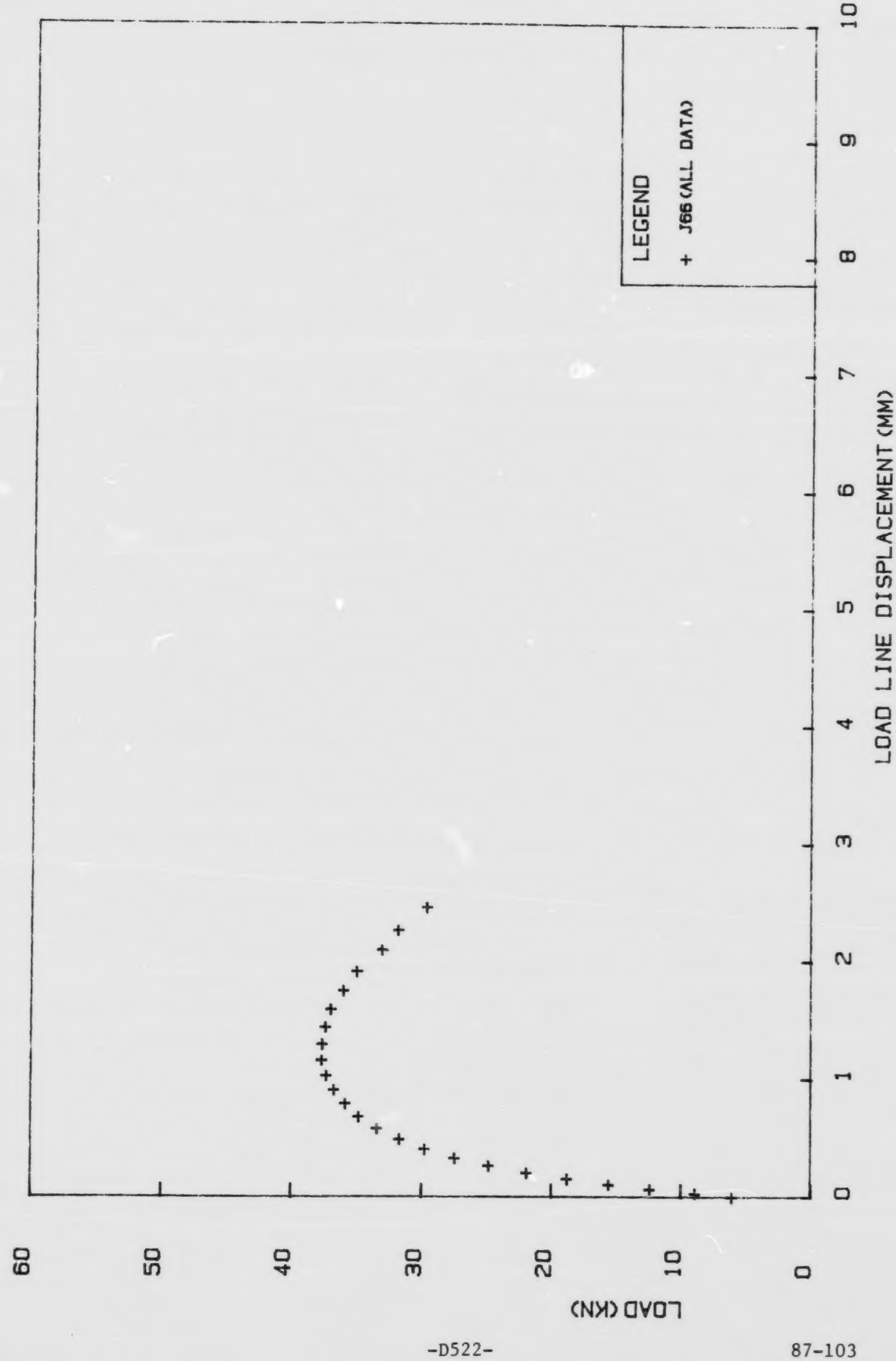
J65

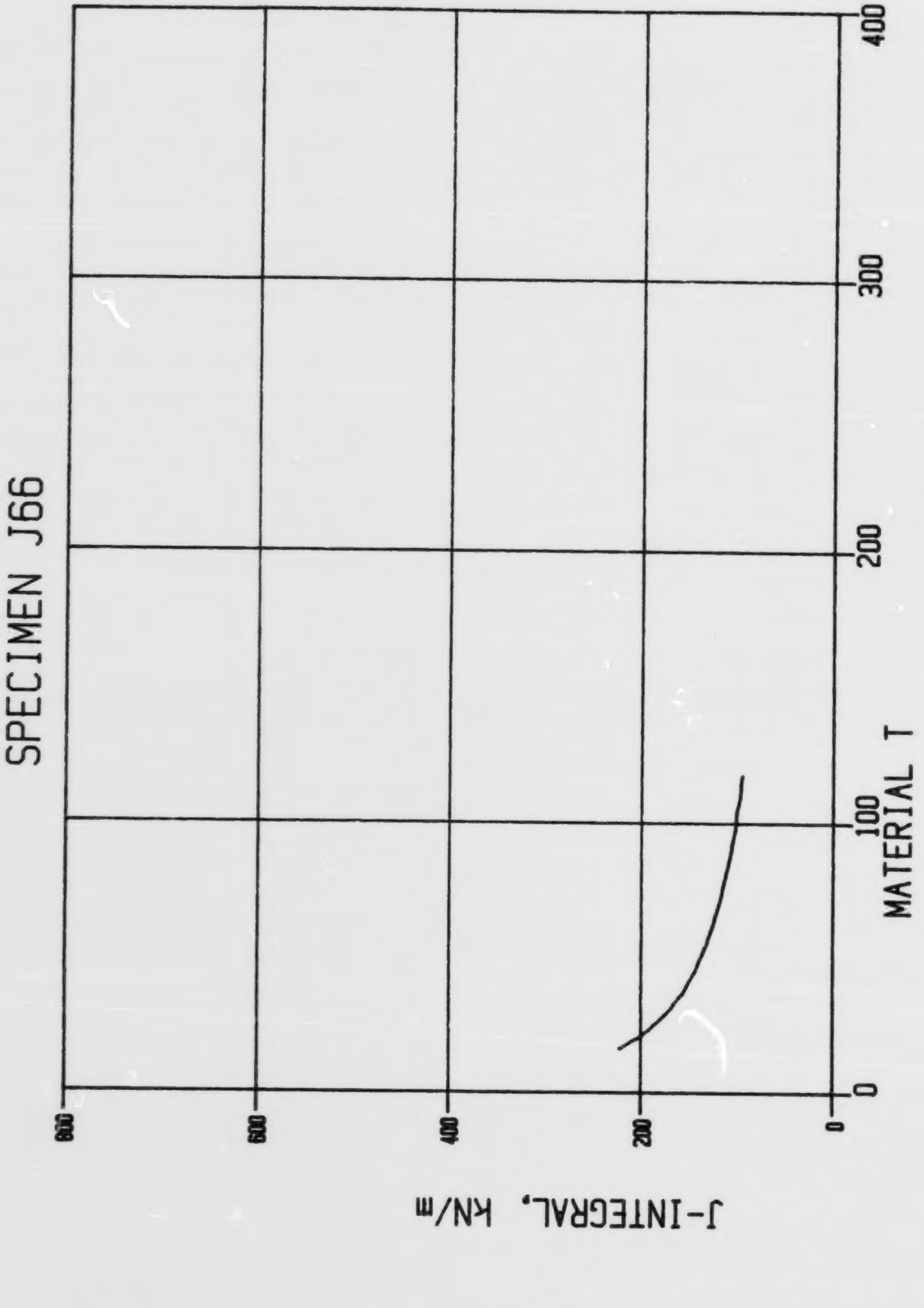
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.08	3.637	3.637	-2E-03	.9975	1
2.18	3.656	3.657	.197	.9991	2
3.65	3.669	3.669	.321	.9995	3
5.78	3.672	3.673	.358	.9984	4
8.6	3.65	3.651	.143	.9995	5
12.42	3.648	3.65	.128	.9994	6
17.96	3.625	3.627	-.101	.9983	7
24.89	3.618	3.62	-.171	.9995	8
33.53	3.625	3.628	-.089	.9994	9
44.27	3.602	3.605	-.316	.9997	10
54.62	3.637	3.641	.036	.9994	11
67.09	3.628	3.633	-.038	.9987	12
80.68	3.615	3.62	-.167	.9992	13
92.41	3.659	3.665	.282	.9995	14
107.55	3.647	3.654	.168	.9994	15
120.37	3.693	3.7	.634	.9994	16
137.01	3.703	3.711	.742	.9994	17
151.72	3.749	3.758	1.21	.9993	18
165.84	3.809	3.819	1.816	.9994	19
181.32	3.862	3.873	2.358	.9997	20
194.74	3.923	3.934	2.974	.9995	21
210.27	3.979	3.99	3.532	.9992	22
224.5	4.039	4.051	4.144	.9998	23
234.49	4.127	4.14	5.027	.9998	24

```
               LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J65
 1              5.676         0
 2              8.606          .028
 3              12.085         .063
 4              15.503         .099
 5              18.86          .139
 6              22.278         .182
 7              25.452         .233
 8              28.198         .297
 9              30.457         .371
 10             32.166         .46
 11             33.63          .559
 12             34.912         .664
 13             35.95          .773
 14             36.804         .886
 15             37.598         1.003
 16             38.208         1.123
 17             38.696         1.25
 18             38.635         1.388
 19             38.33          1.533
 20             37.781         1.686
 21             36.743         1.848
 22             35.95          2.006
 23             34.485         2.18
 24             32.959         2.358
 25             31.006         2.543
```

	J(KN/M)	T	W	J65
1	113.96	37.75	6.42	
2	128.69	211.78	31.77	
3	144.36	43.12	5.66	
4	158.78	31.96	3.73	
5	173.58	39.2	4.09	
6	188.03	29.86	2.81	
7	202.5	38.23	3.26	
8	217.39	31.91	2.47	
9	229.5	15.51	1.09	


SPECIMEN J66(250C)
SLOPE 38
INTERCEPT 89
J1C 94
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J66 (ALL DATA)


SPECIMEN J66
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                    J66
  MATERIAL TYPE                                      A106B
  MATERIAL CONDITION                                 PARENT
  TEST TEMPERATURE(DEG C)                            250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          224
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        506
  CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
  SPECIMEN THICKNESS B(CM)                           3.176
  PERCENT SIDE GROOVE                                19.836
  SPECIMEN WIDTH W(CM)                               6.358
  YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
  EFFECTIVE MODULUS(Pa)                              1.99150659E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           19.25
  INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.674

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                     3.759
  INITIAL A/W                                        .578
  AVERAGE CRACK EXTENSION 9PT(CM)                    .652
  DELTA A(CM) COMPLIANCE                             .628
  MAX DEVIATION OF SINGLE MEASUREMENT %              .83

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                  15
  LAST POINT                   17
  JIC(KN/M)                    94
  CORRELATION COEFF            1
  SLOPE M(MPa)                 38
  INTERCEPT B (KN/M)           89

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD        YES
  LIGAMENT>25JIC/EFFECTIVE YIELD  YES
  DJ/DA<EFFECTIVE YIELD           YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                           NO
  CRACK SIZE DA<0.15*DELTA A                         YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    464.65
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  375.23
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.684
  25*JQ/EF.Y.(CM)                                    .644

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED       15
  LAST DATA POINT USED      24
  CONSTANT(C1)              131.47
  EXPONENT(C2)              .3078
```

J66(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.59	1.21	.01	1.22	1.22	1.29	3.674	1
21.42	2.29	.12	2.41	2.41	2.54	3.653	2
27.46	3.75	.28	4.03	4.04	4.23	3.687	3
33.02	5.43	1.2	6.63	6.63	6.92	3.68	4
38.21	7.27	2.71	9.98	9.98	10.38	3.668	5
43.05	9.23	5.25	14.48	14.46	15	3.657	6
47.71	11.33	8.47	19.8	19.79	20.42	3.661	7
51.46	13.18	13.53	26.71	26.66	27.45	3.651	8
55.23	15.18	19.58	34.76	34.79	35.58	3.664	9
58.67	17.14	27.02	44.16	44.32	45.06	3.678	10
60.52	18.24	37.43	55.67	55.6	56.67	3.66	11
63.13	19.84	47.73	67.58	67.92	68.62	3.683	12
64.85	20.94	60.09	81.03	81.5	82.11	3.688	13
66.34	21.91	73.05	94.96	95.75	96.08	3.699	14
68.05	23.06	86.2	109.25	111.01	110.36	3.725	15
69.44	24.01	100.16	124.17	127.5	125.23	3.762	16
70.74	24.91	114.46	139.37	144.78	140.36	3.803	17
71.9	25.74	129.04	154.78	162.82	155.67	3.848	18
72.81	26.39	143.06	169.45	181.62	170.18	3.91	19
72.59	26.24	159.95	186.18	201.42	186.75	3.95	20
72.56	26.21	173.17	199.38	221.91	199.67	4.036	21
74.46	27.6	181.07	208.67	239.89	208.86	4.127	22
74.32	27.5	191.73	219.23	260.31	219.15	4.223	23
72.9	26.46	203.98	230.44	280.43	230.05	4.302	24

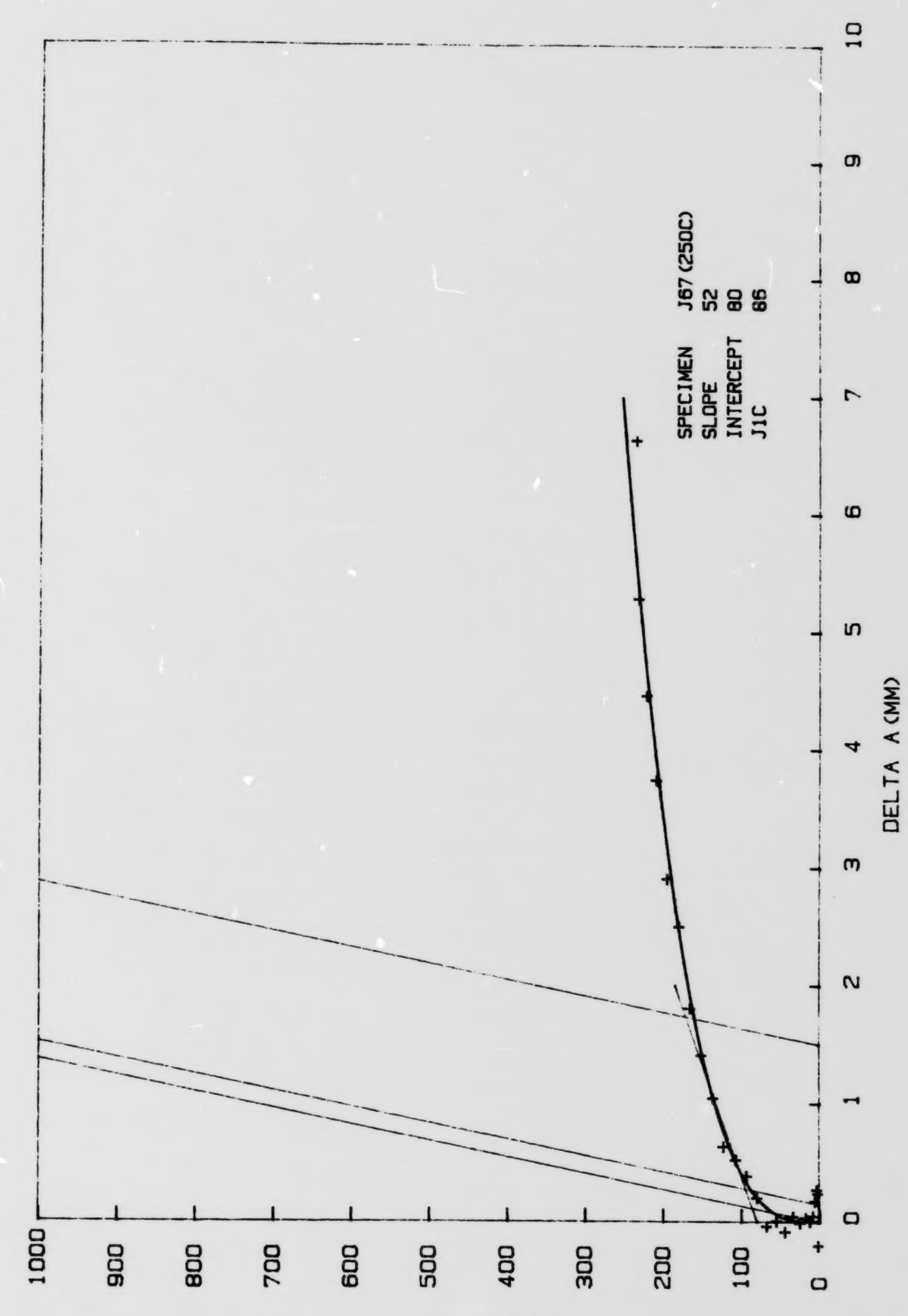
H(M)	D(M)	POISSON'S RATIO
.02384	2.54E-03	.3

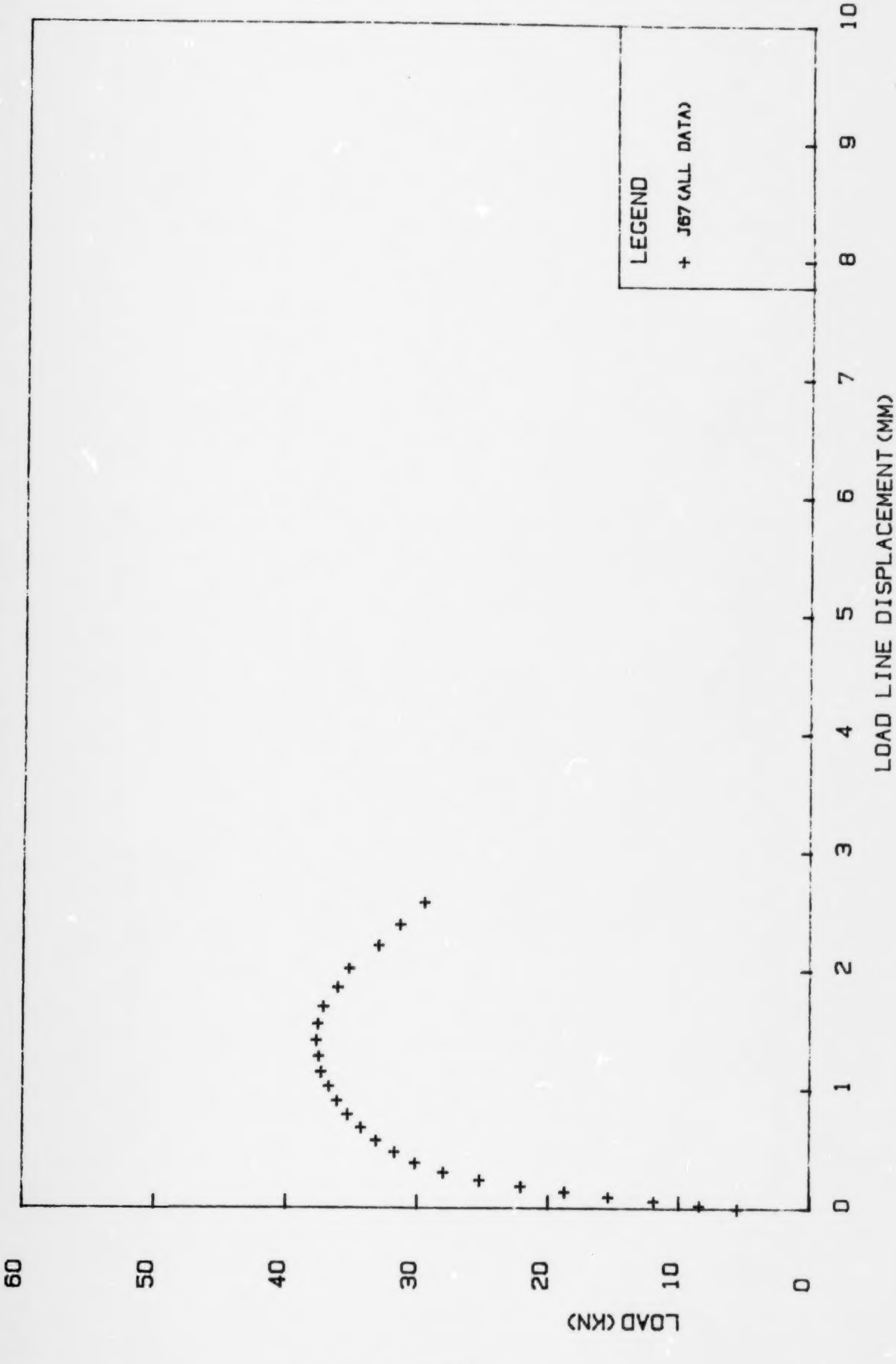
J66

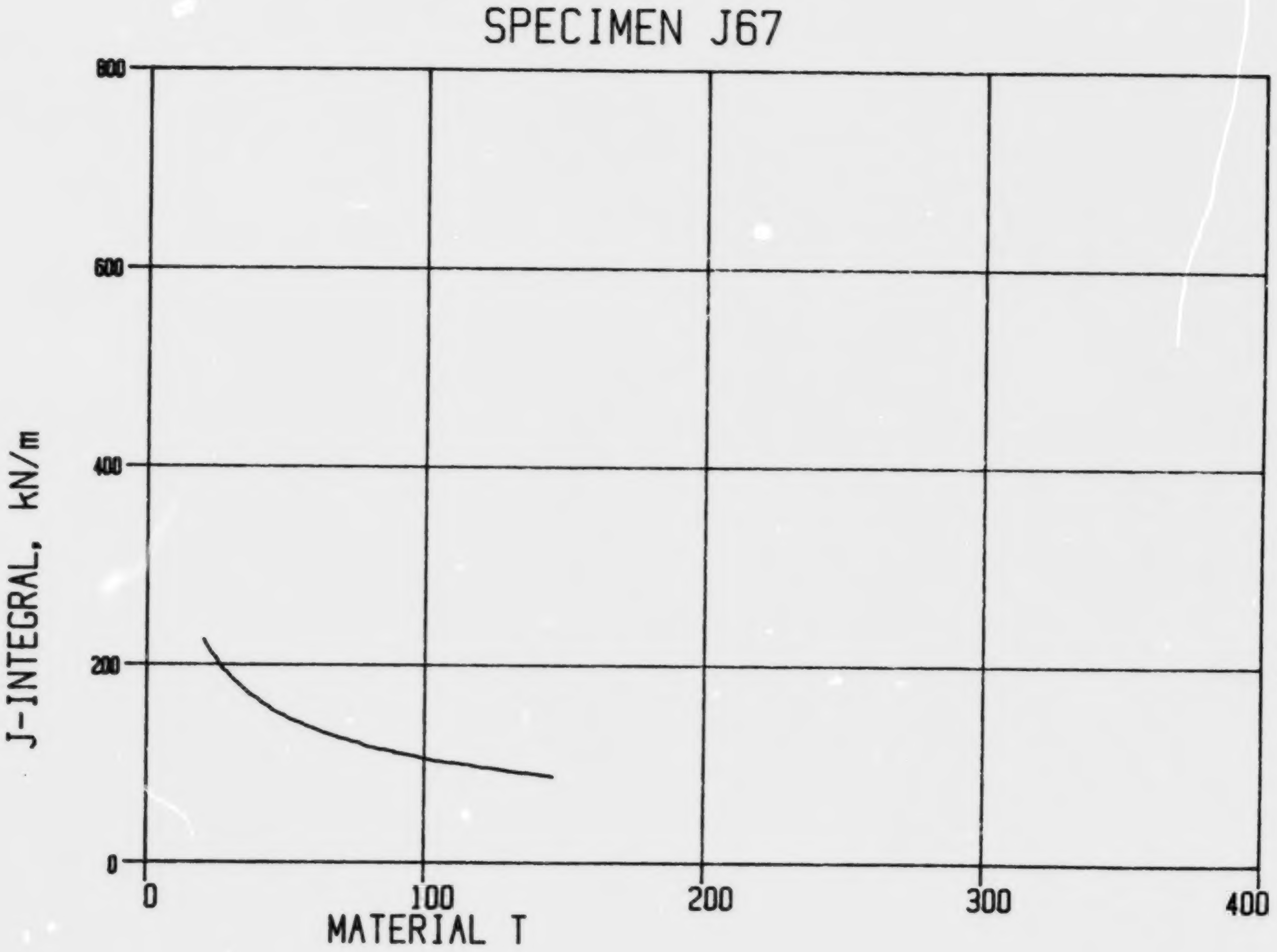
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.22	3.673	3.674	-4E-03	.9984	1
2.41	3.652	3.653	-.212	.9994	2
4.03	3.687	3.687	.134	.9992	3
6.63	3.679	3.68	.059	.9998	4
9.98	3.666	3.668	-.064	.9996	5
14.48	3.655	3.657	-.172	.9993	6
19.8	3.659	3.661	-.132	.9994	7
26.71	3.649	3.651	-.227	.9997	8
34.76	3.661	3.664	-.103	.9998	9
44.16	3.674	3.678	.037	.9991	10
55.67	3.656	3.66	-.137	.9991	11
67.58	3.678	3.683	.085	.9995	12
81.03	3.683	3.688	.142	.9996	13
94.96	3.693	3.699	.248	.9998	14
109.25	3.719	3.725	.515	.9994	15
124.17	3.754	3.762	.88	.9995	16
139.37	3.795	3.803	1.291	.9995	17
154.78	3.839	3.848	1.74	.9996	18
169.45	3.9	3.91	2.359	.9992	19
186.18	3.94	3.95	2.765	.9996	20
199.38	4.025	4.036	3.618	.9992	21
208.67	4.116	4.127	4.53	.9997	22
219.23	4.211	4.223	5.489	.9995	23
230.44	4.29	4.302	6.279	.9995	24

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J66
1	6.042	0	
2	8.911	.029	
3	12.39	.065	
4	15.564	.104	
5	18.799	.151	
6	21.912	.203	
7	24.841	.262	
8	27.466	.327	
9	29.785	.402	
10	31.738	.486	
11	33.447	.579	
12	34.851	.679	
13	35.889	.79	
14	36.743	.906	
15	37.354	1.025	
16	37.72	1.154	
17	37.659	1.292	
18	37.415	1.436	
19	36.987	1.586	
20	36.011	1.746	
21	34.973	1.91	
22	33.02	2.095	
23	31.799	2.263	
24	29.602	2.457	
25	27.344	2.651	

	J(KN/M)	T	W	J66
1	87.99	179.59	39.56	
2	102.11	73.52	13.82	
3	116.71	56.06	9.09	
4	131.77	50.76	7.17	
5	147.08	47.07	5.85	
6	162.12	32.5	3.58	
7	177.82	56.6	5.59	
8	192.78	21.23	1.86	
9	204.02	13.96	1.11	
10	213.95	15.12	1.1	
11	224.84	19.45	1.3	


J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
SPECIMEN J67 (250C)
SLOPE 52
INTERCEPT 80
J1C 86


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J67 (ALL DATA)


SPECIMEN J67
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

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      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J67
 MATERIAL TYPE                                     A106B
 MATERIAL CONDITION                                PARENT
 TEST TEMPERATURE(DEG C)                           250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         224
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       506
 CRACK PLANE ORIENTATION (PER ASTM E399)           C-L
 SPECIMEN THICKNESS B(CM)                          3.177
 PERCENT SIDE GROOVE                               20.05
 SPECIMEN WIDTH W(CM)                              6.367
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.82776E+11
 EFFECTIVE MODULUS(Pa)                             2.03961619E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          18.9
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.649

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.743
 INITIAL A/W                                       .573
 AVERAGE CRACK EXTENSION 9PT(CM)                   .679
 DELTA A(CM) COMPLIANCE                            .663
 MAX DEVIATION OF SINGLE MEASUREMENT %             .76

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                          14
 LAST POINT                           18
 JIC(KN/M)                            86
 CORRELATION COEFF                    .93
 SLOPE M(MPa)                         52
 INTERCEPT B (KN/M)                   80

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD             YES
 LIGAMENT>25JIC/EFFECTIVE YIELD       YES
 DJ/DA<EFFECTIVE YIELD                YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          YES
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   463.55
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 375
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.718
 25*JQ/EF.Y.(CM)                                   .589

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED           14
 LAST DATA POINT USED          25
 CONSTANT(C1)                  134.66
 EXPONENT(C2)                  .3269
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J67(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
14.33	1.02	0	1.03	1.03	1.1	3.629	1
20.77	2.15	-.06	2.09	2.09	2.2	3.673	2
26.89	3.6	.02	3.62	3.62	3.82	3.677	3
32.58	5.28	.57	5.86	5.86	6.15	3.667	4
38.13	7.24	1.47	8.71	8.7	9.11	3.654	5
43.5	9.42	3.02	12.44	12.43	12.96	3.65	6
48.32	11.62	6.22	17.84	17.84	18.48	3.653	7
51.86	13.39	11.73	25.13	25.11	25.86	3.648	8
54.77	14.94	19.26	34.19	34.21	35.01	3.654	9
56.77	16.04	28.32	44.36	44.26	45.26	3.641	10
59.06	17.37	38.19	55.56	55.58	56.5	3.65	11
60.69	18.34	49.77	68.11	68.04	69.12	3.646	12
62.92	19.71	60.73	80.44	80.96	81.47	3.67	13
64.67	20.82	73.02	93.84	94.91	94.89	3.688	14
66.27	21.87	85.67	107.54	109.1	108.61	3.702	15
67.03	22.37	100.82	123.19	125.21	124.26	3.713	16
69.01	23.71	113.11	136.82	140.9	137.87	3.754	17
70.32	24.62	127.04	151.66	157.81	152.66	3.79	18
71.23	25.26	141.24	166.5	175.2	167.42	3.83	19
72.2	25.95	154.4	180.35	194.07	181.11	3.899	20
72.34	26.06	170.04	196.09	213.09	196.72	3.94	21
71.56	25.49	184.58	210.08	234.63	210.38	4.023	22
71.41	25.39	196.79	222.17	253.96	222.27	4.095	23
71.28	25.3	207.38	232.68	273.52	232.55	4.177	24
71.69	25.59	210.14	235.73	292.69	235.57	4.312	25

H(M)	D(M)	POISSON'S RATIO
.02387	2.54E-03	.3

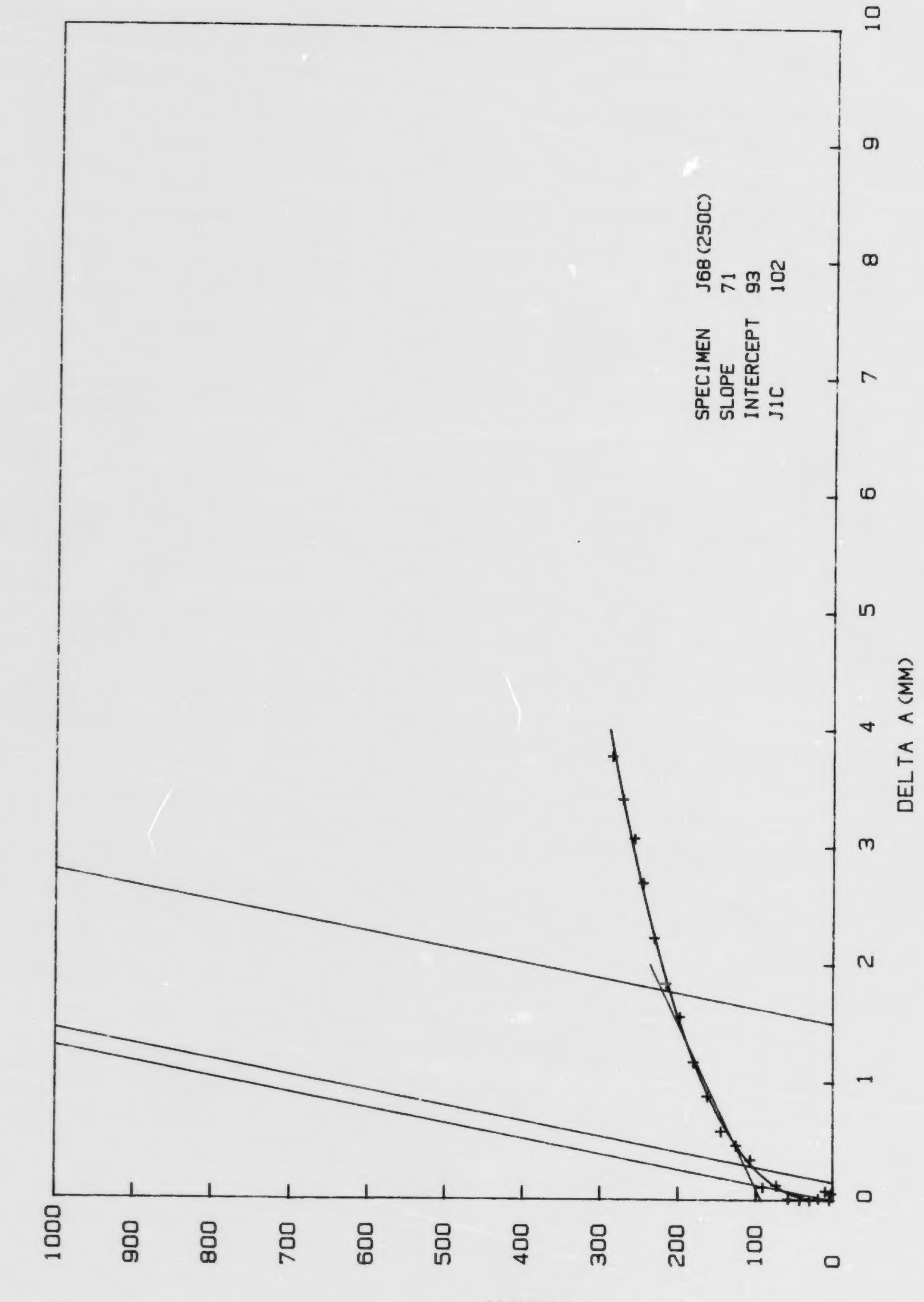
J67

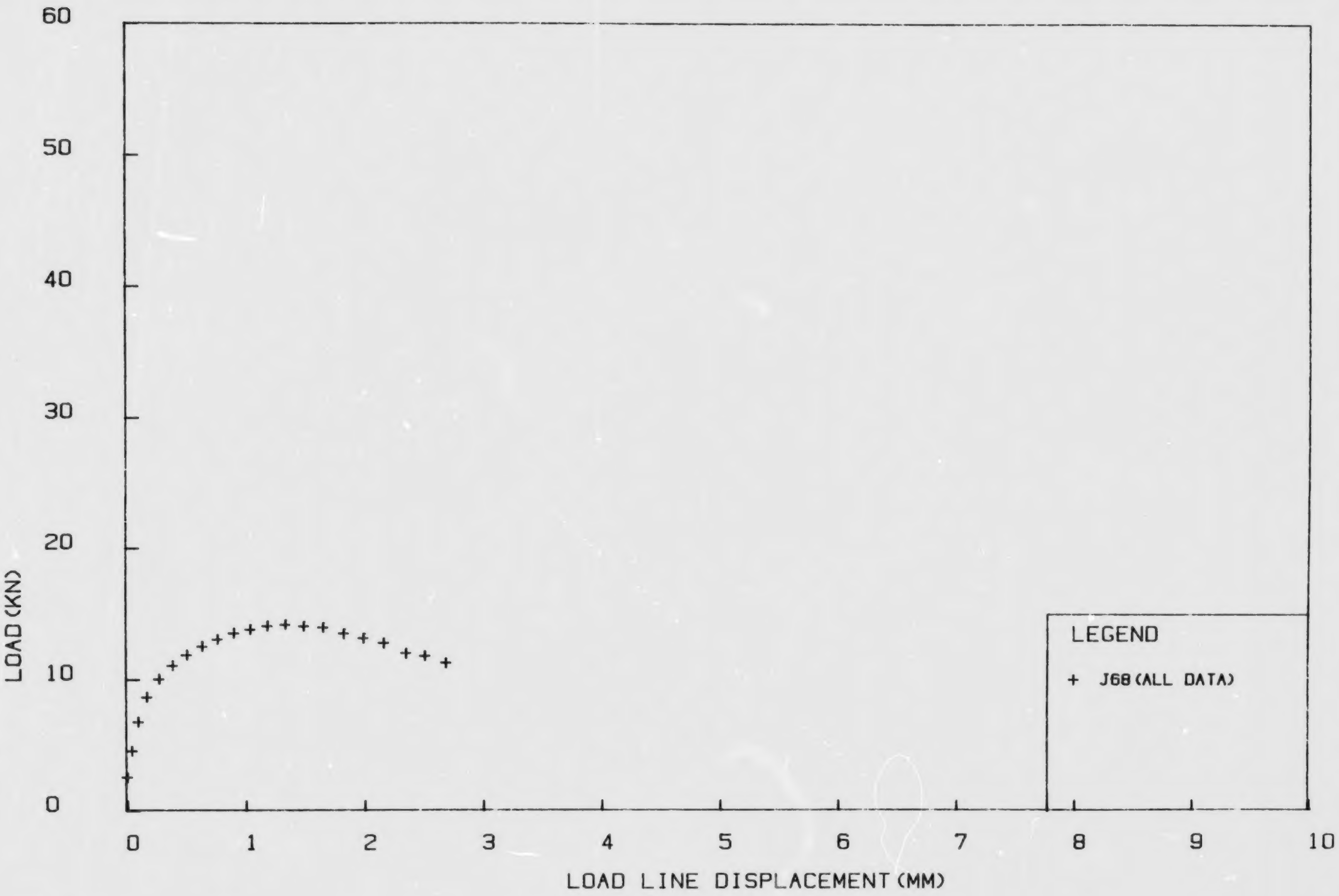
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.03	3.629	3.629	-.196	.9996	1
2.09	3.673	3.673	.244	.9996	2
3.62	3.676	3.677	.276	.9993	3
5.86	3.666	3.667	.18	.9997	4
8.71	3.653	3.654	.052	.9991	5
12.44	3.648	3.65	6E-03	.9995	6
17.84	3.651	3.653	.04	.9998	7
25.13	3.646	3.648	-6E-03	.9994	8
34.19	3.651	3.654	.051	.9996	9
44.36	3.637	3.641	-.081	.9998	10
55.56	3.646	3.65	.012	.9998	11
68.11	3.641	3.646	-.034	.9998	12
80.44	3.664	3.67	.208	.9996	13
93.84	3.682	3.688	.392	.9992	14
107.54	3.695	3.702	.528	.9996	15
123.19	3.705	3.713	.639	.9999	16
136.82	3.745	3.754	1.048	.9995	17
151.66	3.781	3.79	1.413	.9996	18
166.5	3.82	3.83	1.809	.9996	19
180.35	3.889	3.899	2.501	.9996	20
196.09	3.929	3.94	2.906	.9989	21
210.08	4.012	4.023	3.743	.9995	22
222.17	4.083	4.095	4.46	.9998	23
232.68	4.165	4.177	5.282	.9997	24
235.73	4.3	4.312	6.632	.9997	25

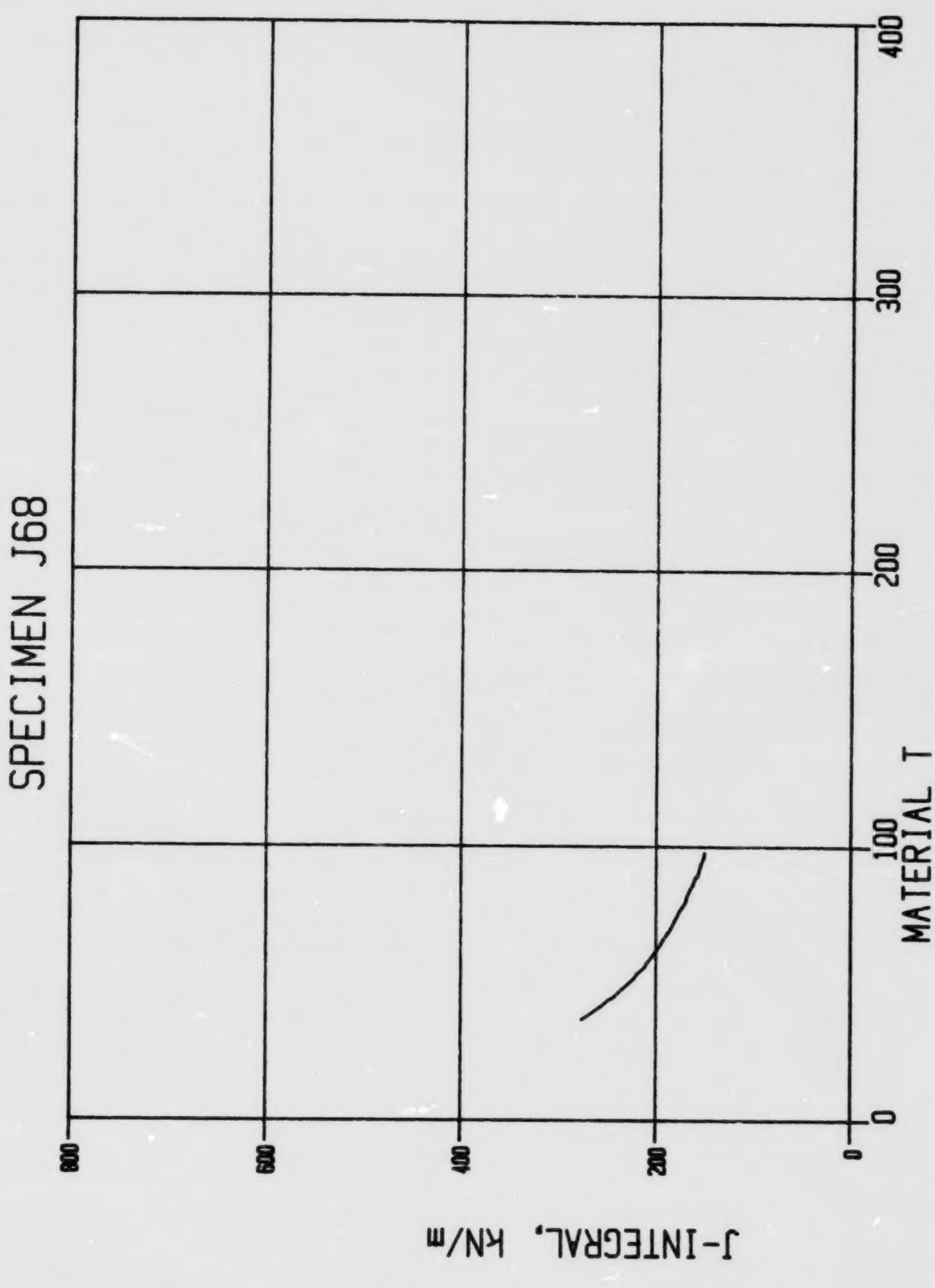
J67

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	5.493	0
2	8.423	.028
3	11.902	.063
4	15.381	.1
5	18.738	.142
6	22.095	.186
7	25.269	.236
8	28.015	.3
9	30.151	.378
10	31.738	.471
11	33.142	.566
12	34.302	.673
13	35.339	.784
14	36.133	.9
15	36.743	1.021
16	37.354	1.14
17	37.537	1.273
18	37.72	1.406
19	37.598	1.547
20	37.17	1.691
21	36.072	1.853
22	35.217	2.012
23	32.959	2.205
24	31.311	2.382
25	29.48	2.568
26	26.794	2.776

	J(KN/M)	T	W	J67
1	87.14	100.15	22.44	
2	100.69	137.7	26.57	
3	115.36	194.38	32.6	
4	130	45.68	6.69	
5	144.24	55.9	7.28	
6	159.08	51.34	5.97	
7	173.43	27.45	2.85	
8	188.22	53.38	5.02	
9	203.09	22.92	1.93	
10	216.13	23.15	1.77	
11	227.43	17.52	1.23	
12	234.2	3.1	.2	


SPECIMEN J68 (250C)
SLOPE 71
INTERCEPT 93
J1C 102
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J68 (ALL DATA)


SPECIMEN J68
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

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      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

   SPECIMEN NUMBER                                    J68
   MATERIAL TYPE                                      A106B
   MATERIAL CONDITION                                 PARENT
   TEST TEMPERATURE(DEG C)                            250
   MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          218
   MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        554.9
   CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
   SPECIMEN THICKNESS B(CM)                           1.905
   PERCENT SIDE GROOVE                                20.367
   SPECIMEN WIDTH W(CM)                               3.807
   YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
   EFFECTIVE MODULUS(Pa)                              2.01492955E+11

                 FATIGUE PRE-CRACKING DATA

   MAX LOAD IN PRE-CRACKING(LAST 50%) KN              5
   MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           18.01
   INITIAL CRACK LENGTH-COMPLIANCE(CM)                2.283

                 CRACK LENGTH MEASUREMENT

   AVERAGE FATIGUE LENGTH 9PT(CM)                     2.345
   INITIAL A/W                                        .6
   AVERAGE CRACK EXTENSION 9PT(CM)                    .392
   DELTA A(CM) COMPLIANCE                             .377
   MAX DEVIATION OF SINGLE MEASUREMENT %              .78

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

   FIRST POINT                   10
   LAST POINT                    15
   JIC(KN/M)                     102
   CORRELATION COEFF             .95
   SLOPE M(MPa)                  71
   INTERCEPT B (KN/M)            93

                 VALIDITY(JIC)

   BN>25JIC/EFFECTIVE YIELD       YES
   LIGAMENT>25JIC/EFFECTIVE YIELD YES
   DJ/DA<EFFECTIVE YIELD          YES

                 QUALIFICATION OF R-CURVE DATA

   CRACK EXTENSION VALIDITY                           YES
   CRACK SIZE DA<0.15*DELTA A                         YES
   J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    293.12
   OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  221.66
   DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   1.524
   25*JQ/EF.Y.(CM)                                    .66

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

   1st DATA POINT USED       10
   LAST DATA POINT USED      21
   CONSTANT(C1)              169.07
   EXPONENT(C2)              .3877
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          J68(250C)

K          J-ELASTIC     J-PLASTIC    JEL+JPL     J(M)       J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)        (KN/M)       (KN/M)     (KN/M)        (KN/M)      (CM)

18.89      1.78          .03          1.81       1.81         1.91      2.289  1
27.92      3.88          .8           4.68       4.68         4.92      2.283  2
35.93      6.43          3.54         9.97       9.97         10.35     2.291  3
41.33      8.5           10.5         19         18.99        19.55     2.285  4
45.47      10.3          20.08        30.37      30.34        31.04     2.283  5
48.8       11.86         31.64        43.5       43.48        44.27     2.283  6
51.56      13.23         45.08        58.31      58.31        59.17     2.284  7
54.41      14.74         58.8         73.54      73.98        74.4      2.296  8
56.25      15.75         75.18        90.93      91.29        91.88     2.294  9
58.89      17.26         89.83        107.1      108.96       107.96    2.317  10
60.81      18.41         106.97       125.38     128.2        126.22    2.329  11
62         19.14         125.64       144.78     148.7        145.56    2.341  12
63.49      20.07         142.36       162.42     169.64       163.01    2.371  13
65.12      21.11         159.25       180.36     191.29       180.77    2.4    14
65.64      21.45         176.51       197.96     214.44       198.06    2.438  15
66.13      21.77         193.87       215.65     236.76       215.52    2.467  16
67.35      22.58         208.31       230.89     259.1        230.53    2.505  17
67.02      22.36         223.11       245.47     283.13       244.75    2.552  18
69.24      23.87         232.97       256.85     302.95       256.03    2.59   19
68.93      23.65         248.03       271.69     325.71       270.59    2.623  20
67.57      22.73         262.78       285.51     348.96       284.09    2.66   21

H(M)             D(M)            POISSON'S RATIO
.014298          2.54E-03        .3
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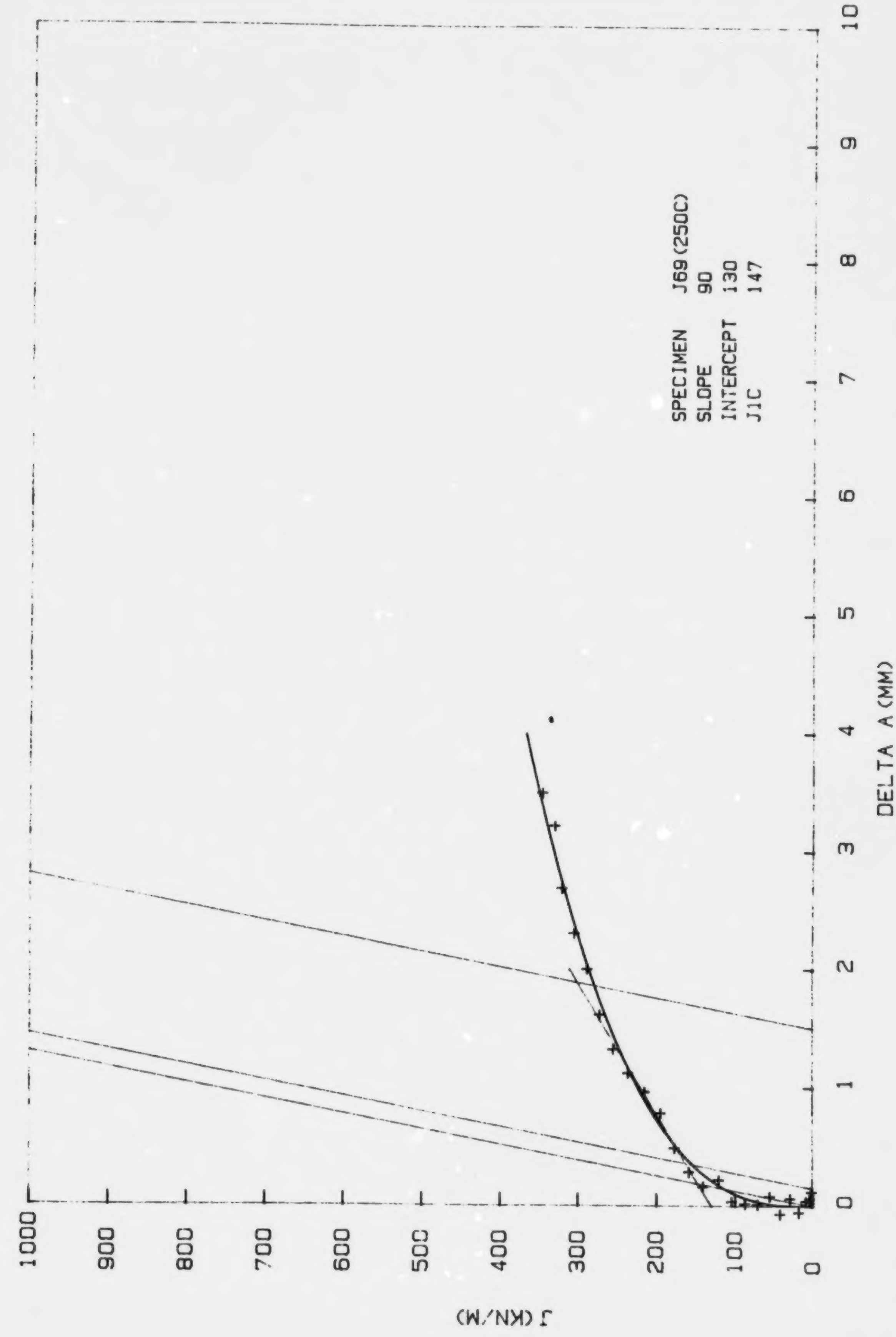
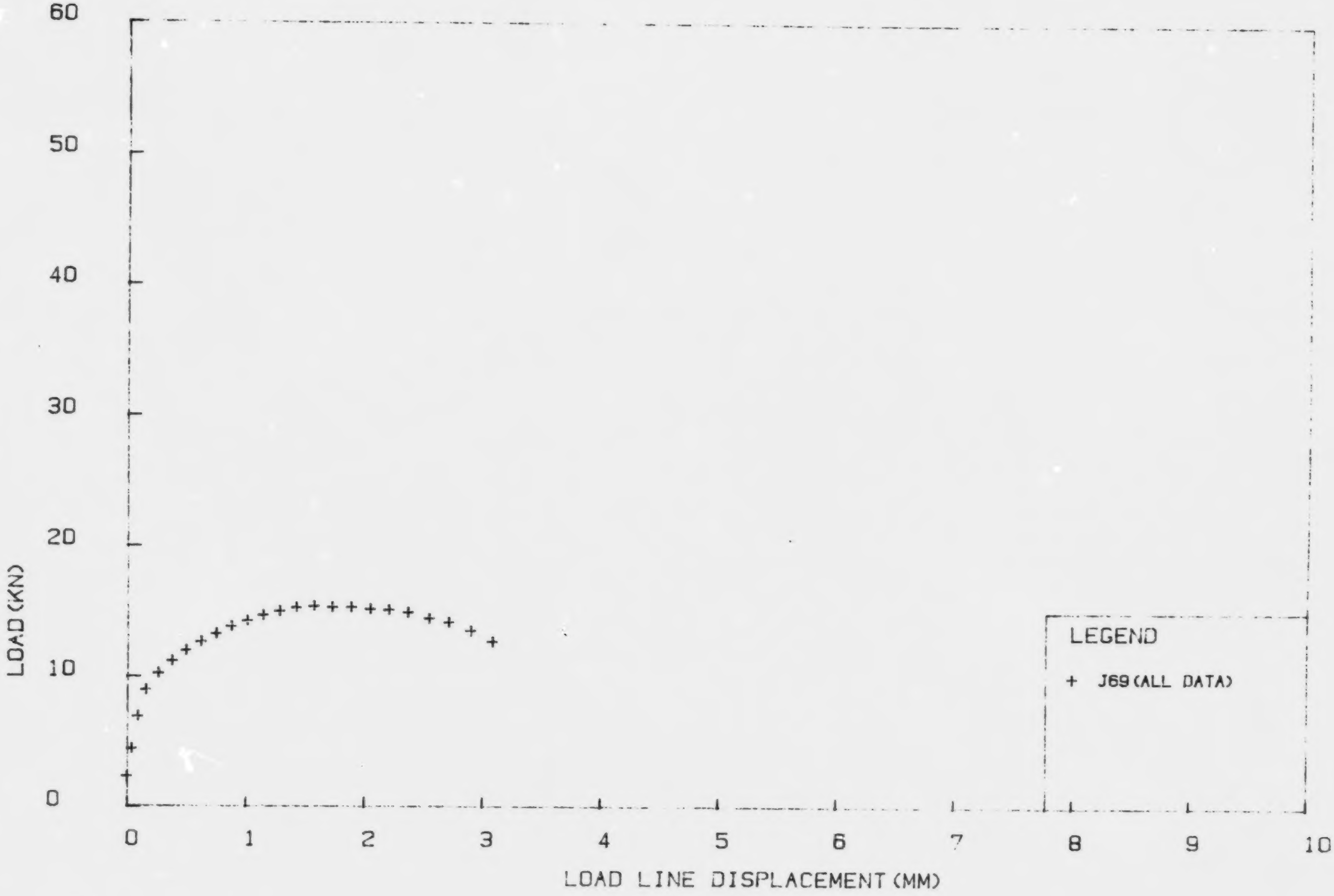
J68

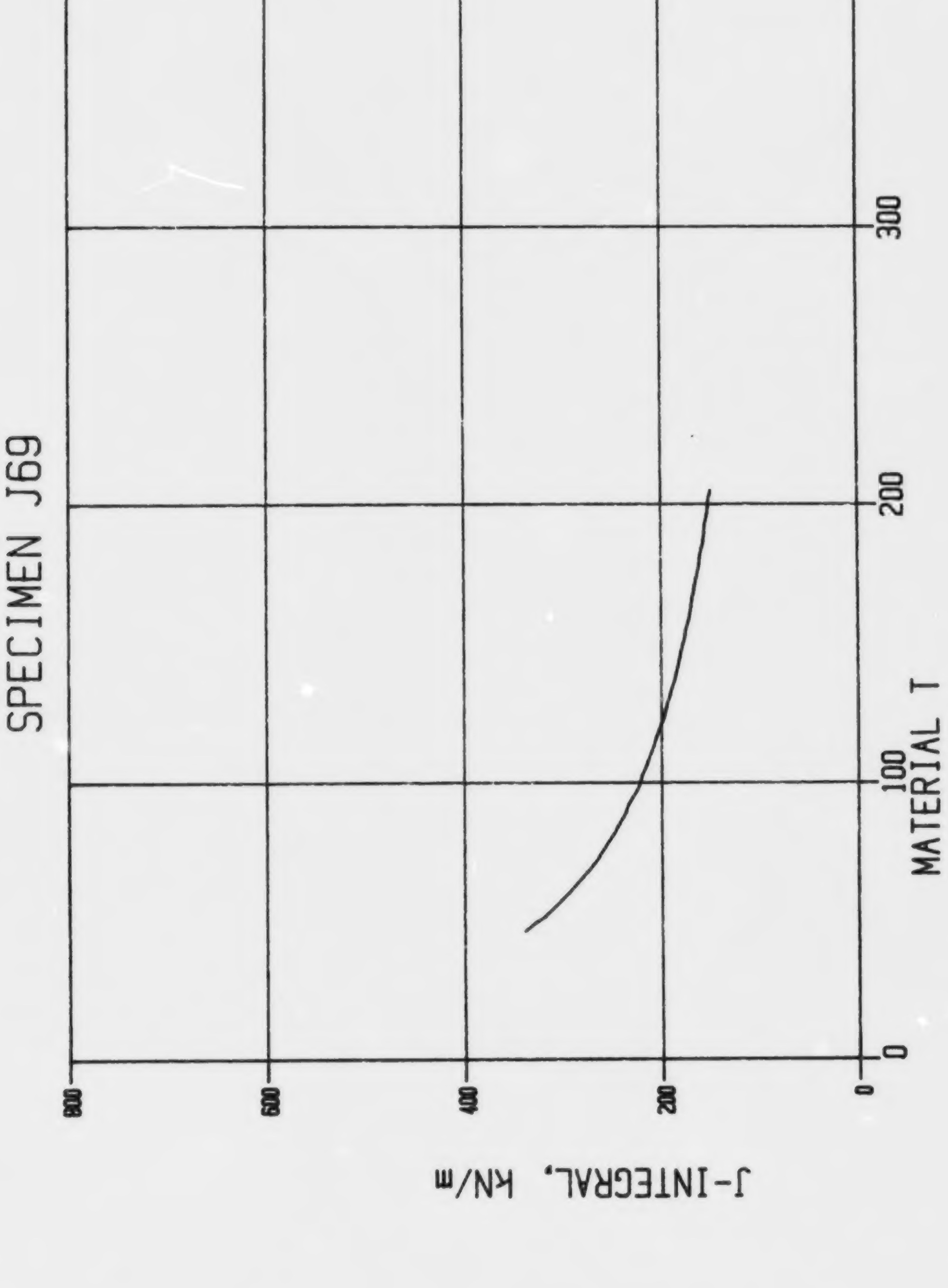
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.81	2.289	2.289	.06	.9991	1
4.68	2.283	2.283	4E-03	.9999	2
9.97	2.29	2.291	.079	.9999	3
19	2.283	2.285	.017	.9995	4
30.37	2.281	2.283	1E-03	.9997	5
43.5	2.28	2.283	4E-03	.9996	6
58.31	2.28	2.284	.012	.9992	7
73.54	2.291	2.296	.127	.9998	8
90.93	2.289	2.294	.11	.9998	9
107.1	2.311	2.317	.344	.9997	10
125.38	2.322	2.329	.465	.9999	11
144.78	2.333	2.341	.583	.9999	12
162.42	2.362	2.371	.88	.9997	13
180.36	2.391	2.4	1.171	.9992	14
197.96	2.428	2.438	1.554	.9999	15
215.65	2.456	2.467	1.836	.9996	16
230.89	2.494	2.505	2.223	.9996	17
245.47	2.54	2.552	2.692	.9997	18
256.85	2.578	2.59	3.072	.9997	19
271.69	2.611	2.623	3.404	.9997	20
285.51	2.647	2.66	3.768	.9998	21

```
             LOAD(KN)        LOAD LINE DISPLACEMENT(MM)      J68
 1            2.515           0
 2            4.565           .04
 3            6.787           .095
 4            8.667           .17
 5           10.034           .271
 6           11.06            .385
 7           11.865           .505
 8           12.524           .634
 9           13.062           .764
 10          13.525           .9
 11          13.818          1.039
 12          14.087          1.183
 13          14.185          1.333
 14          14.063          1.489
 15          13.965          1.649
 16          13.477          1.823
 17          13.135          1.989
 18          12.769          2.159
 19          11.987          2.349
 20          11.792          2.506
 21          11.23           2.684
 22          10.474          2.874
```

	J(KN/M)	T	W	J68
1	99.01	84.69	10.41	
2	116.24	184.69	19.18	
3	135.08	201.35	17.85	
4	153.6	72.67	5.55	
5	171.39	75.45	5.06	
6	189.16	56.31	3.33	
7	206.8	76.6	4.06	
8	223.27	48.16	2.29	
9	238.18	38.13	1.64	
10	251.16	36.6	1.45	
11	264.27	54.62	2	
12	278.6	46.48	1.56	


SPECIMEN J69(250C)
SLOPE 90
INTERCEPT 130
J1C 147
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J69 (ALL DATA)


SPECIMEN J69
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J69
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	218
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	554.9
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	1.906
PERCENT SIDE GROOVE	20.619
SPECIMEN WIDTH W(CM)	3.812
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.00475562E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	16.93
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.225

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	2.292
INITIAL A/W	.584
AVERAGE CRACK EXTENSION 9PT(CM)	.356
DELTA A(CM) COMPLIANCE	.349
MAX DEVIATION OF SINGLE MEASUREMENT %	.82

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	14
LAST POINT	19
JIC(KN/M)	147
CORRELATION COEFF	.98
SLOPE M(MPa)	90
INTERCEPT B (KN/M)	130

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	292.35
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	239.17
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.587
25*JQ/EF.Y.(CM)	.951

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	14
LAST DATA POINT USED	24
CONSTANT(C1)	224.25
EXPONENT(C2)	.3567

J69(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
17.5	1.52	.02	1.54	1.54	1.61	2.237	1
27.09	3.65	.43	4.08	4.08	4.29	2.232	2
34.91	6.07	3.02	9.09	9.09	9.44	2.229	3
39.47	7.76	10.47	18.22	18.2	18.72	2.22	4
43.64	9.48	19.86	29.34	29.42	29.88	2.232	5
46.17	10.62	31.79	42.41	42.27	43.09	2.219	6
49.43	12.17	43.53	55.69	55.95	56.38	2.234	7
51.46	13.18	58.25	71.44	71.44	72.23	2.227	8
53.66	14.33	73.07	87.41	87.43	88.27	2.227	9
55.48	15.32	89.31	104.64	104.78	105.54	2.229	10
58.22	16.87	103.96	120.83	122.32	121.71	2.247	11
59.14	17.41	123.38	140.79	141.79	141.75	2.242	12
60.95	18.5	140.48	158.98	161.27	159.91	2.254	13
62.6	19.51	157.98	177.49	182.15	178.33	2.274	14
64.23	20.54	174.7	195.23	203.87	195.91	2.304	15
65.43	21.32	194.36	215.68	226.99	216.25	2.321	16
66.02	21.7	214.83	236.53	250.53	236.98	2.337	17
67.13	22.43	233.4	255.84	273.6	256.17	2.357	18
68.42	23.3	250	273.3	297.12	273.47	2.387	19
69.13	23.79	265.75	289.55	322.1	289.46	2.425	20
70.24	24.56	281.45	306.01	345.92	305.76	2.455	21
69.95	24.36	297.24	321.6	371.55	321.06	2.494	22
70.06	24.44	306.1	330.54	395.55	329.82	2.546	23
70.63	24.83	321.77	346.6	420.02	345.69	2.574	24

H(M)	D(M)	POISSON'S RATIO
.01429	2.54E-03	.3

J69

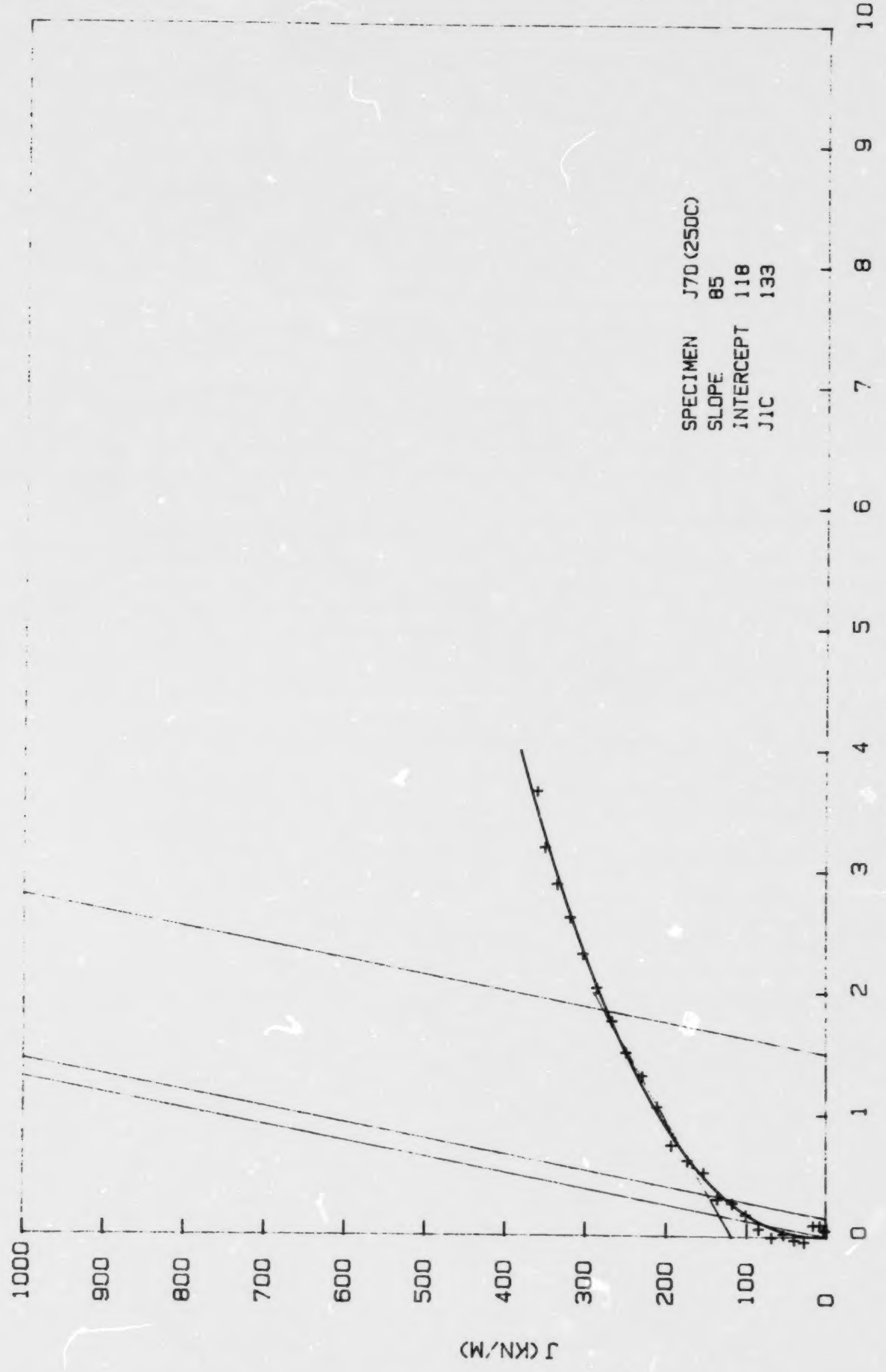
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.54	2.237	2.237	.124	.9995	1
4.08	2.231	2.232	.065	.9999	2
9.09	2.228	2.229	.044	.9999	3
18.22	2.218	2.22	-.051	.9999	4
29.34	2.229	2.232	.068	.9998	5
42.41	2.215	2.219	-.064	.9998	6
55.69	2.23	2.234	.086	.9999	7
71.44	2.222	2.227	.016	.9997	8
87.41	2.221	2.227	.02	.9999	9
104.64	2.223	2.229	.041	.9999	10
120.83	2.24	2.247	.222	.9997	11
140.79	2.233	2.242	.165	.9997	12
158.98	2.245	2.254	.291	.9998	13
177.49	2.264	2.274	.491	.9997	14
195.23	2.293	2.304	.787	.9998	15
215.68	2.31	2.321	.965	.9998	16
236.53	2.325	2.337	1.124	.9998	17
255.84	2.344	2.357	1.324	.9997	18
273.3	2.373	2.387	1.616	.9998	19
289.55	2.411	2.425	2.004	.9999	20
306.01	2.44	2.455	2.304	1	21
321.6	2.478	2.494	2.685	1	22
330.54	2.531	2.546	3.214	.9999	23
346.6	2.558	2.574	3.492	.9998	24

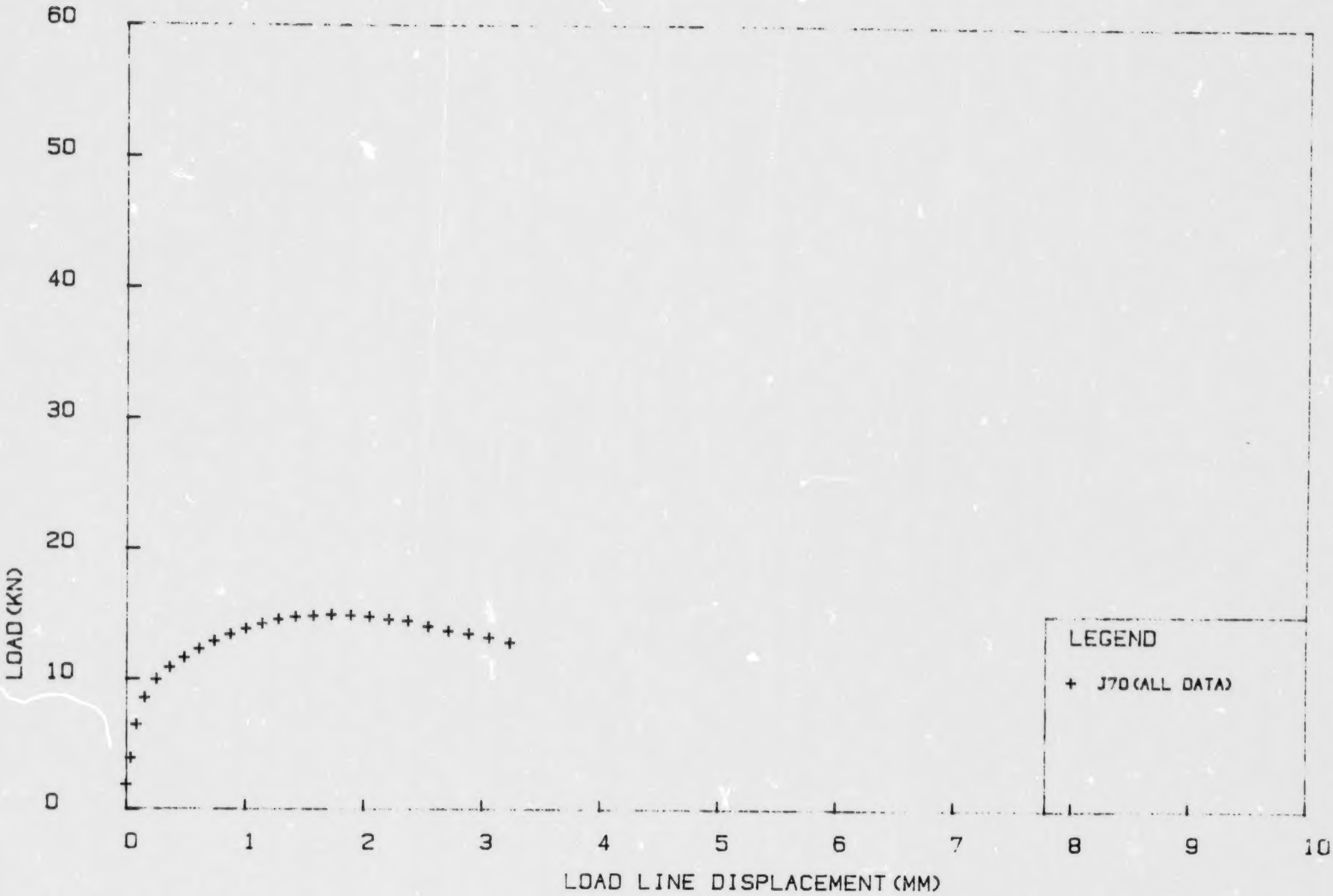
J69

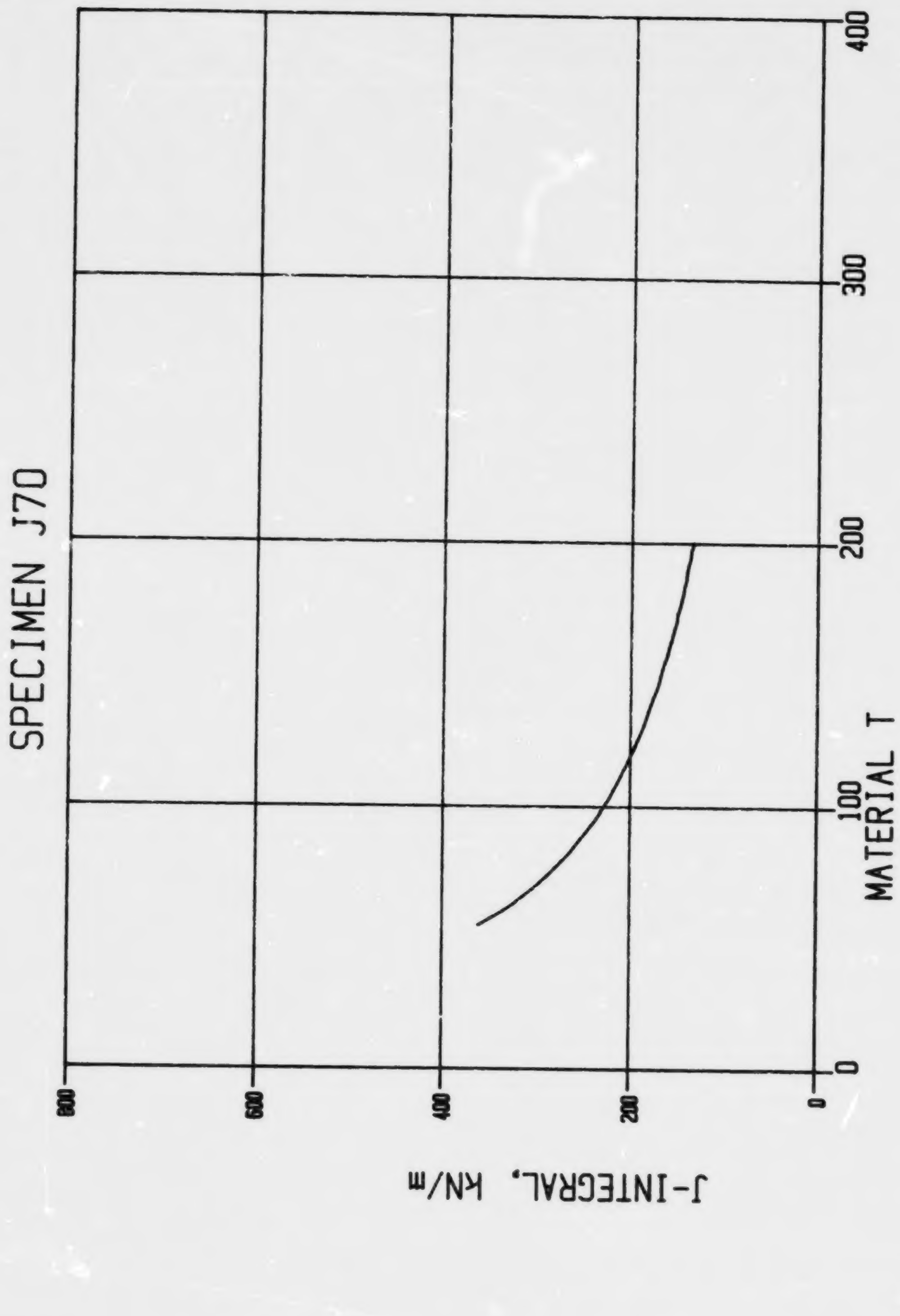
	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	2.271	0
2	4.468	.039
3	6.958	.089
4	8.984	.159
5	10.254	.261
6	11.206	.377
7	12.012	.496
8	12.671	.619
9	13.281	.747
10	13.843	.875
11	14.282	1.01
12	14.722	1.144
13	15.039	1.283
14	15.308	1.423
15	15.405	1.572
16	15.332	1.727
17	15.332	1.887
18	15.21	2.048
19	15.137	2.207
20	14.941	2.371
21	14.453	2.548
22	14.185	2.715
23	13.501	2.899
24	12.671	3.083
25	12.329	3.264

```
      J(KN/M)            T            W      J69

1       149.89      177.17          15.05
2       168.24      113.06          8.44
3       186.36      73.36           4.85
4       205.46      140.82          8.35
5       226.11      160.56          8.56
6       246.18      118.2           5.71
7       264.57      73.13           3.22
8       281.43      51.22           2.06
9       297.78      67.08           2.5
10      313.81      50.08           1.72
11      326.07      20.69           .66
12      338.57      70.81           2.12
```


SPECIMEN J70(250C)
SLOPE 85
INTERCEPT 118
J1C 133
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J70 (ALL DATA)



SPECIMEN J70

```
     DATA SHEET-J1-R CURVE TEST

                   TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J70
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            218
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          554.9
 CRACK PLANE ORIENTATION (PER ASTM E399)              C-L
 SPECIMEN THICKNESS B(CM)                             1.906
 PERCENT SIDE GROOVE                                  20.724
 SPECIMEN WIDTH W(CM)                                 3.808
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.82776E+11
 EFFECTIVE MODULUS(Pa)                                2.07041058E+11

                   FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             17.18
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  2.237

                   CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       2.317
 INITIAL A/W                                          .587
 AVERAGE CRACK EXTENSION 9PT(CM)                      .357
 DELTA A(CM) COMPLIANCE                               .366
 MAX DEVIATION OF SINGLE MEASUREMENT %                .67

                   ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                          13
 LAST POINT                           19
 JIC(KN/M)                            133
 CORRELATION COEFF                    .98
 SLOPE M(MPa)                         85
 INTERCEPT B (KN/M)                   118

                   VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD             YES
 LIGAMENT>25JIC/EFFECTIVE YIELD       YES
 DJ/DA<EFFECTIVE YIELD                YES

                   QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                            NO
 CRACK SIZE DA<0.15*DELTA A                          NO
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     291.96
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   232.8
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    1.571
 25*JQ/EF.Y.(CM)                                     .86

                   CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED         13
 LAST DATA POINT USED        25
 CONSTANT(C1)                209.54
 EXPONENT(C2)                .434
```

J70(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.52	1.2	0	1.2	1.2	1.27	2.242	1
25.77	3.31	.15	3.45	3.45	3.65	2.243	2
33.99	5.75	2.36	8.12	8.12	8.45	2.247	3
39.51	7.77	8.82	16.59	16.59	17.05	2.247	4
42.6	9.04	18.83	27.87	27.77	28.48	2.233	5
45.64	10.37	30.05	40.42	40.34	41.11	2.235	6
48.45	11.69	42.49	54.18	54.22	54.92	2.239	7
50.72	12.81	56.41	69.21	69.16	70.04	2.237	8
53.1	14.04	70.99	85.03	85.31	85.89	2.244	9
55.48	15.32	85.73	101.05	102.01	101.9	2.255	10
57.58	16.51	101.55	118.06	119.71	118.92	2.265	11
59.16	17.42	119.1	136.52	138.45	137.42	2.268	12
61.31	18.71	134.92	153.64	157.76	154.45	2.29	13
62.23	19.28	154.54	173.82	179.08	174.59	2.299	14
63.48	20.06	173.7	193.76	200.71	194.47	2.312	15
65.32	21.24	190.37	211.61	223.32	212.14	2.344	16
66.8	22.22	207.58	229.79	245.72	230.18	2.369	17
67.23	22.5	227.71	250.22	269.74	250.44	2.388	18
68.74	23.53	244.24	267.76	292.59	267.86	2.414	19
68.64	23.46	263	286.45	317.34	286.31	2.441	20
69.19	23.83	279.84	303.67	341.37	303.33	2.469	21
70.72	24.9	294.6	319.5	365.21	319.01	2.499	22
71.56	25.5	310.37	335.87	389.39	335.21	2.527	23
72.13	25.9	325.36	351.26	413.96	350.41	2.557	24
71.66	25.56	335.69	361.25	439.05	360.18	2.603	25

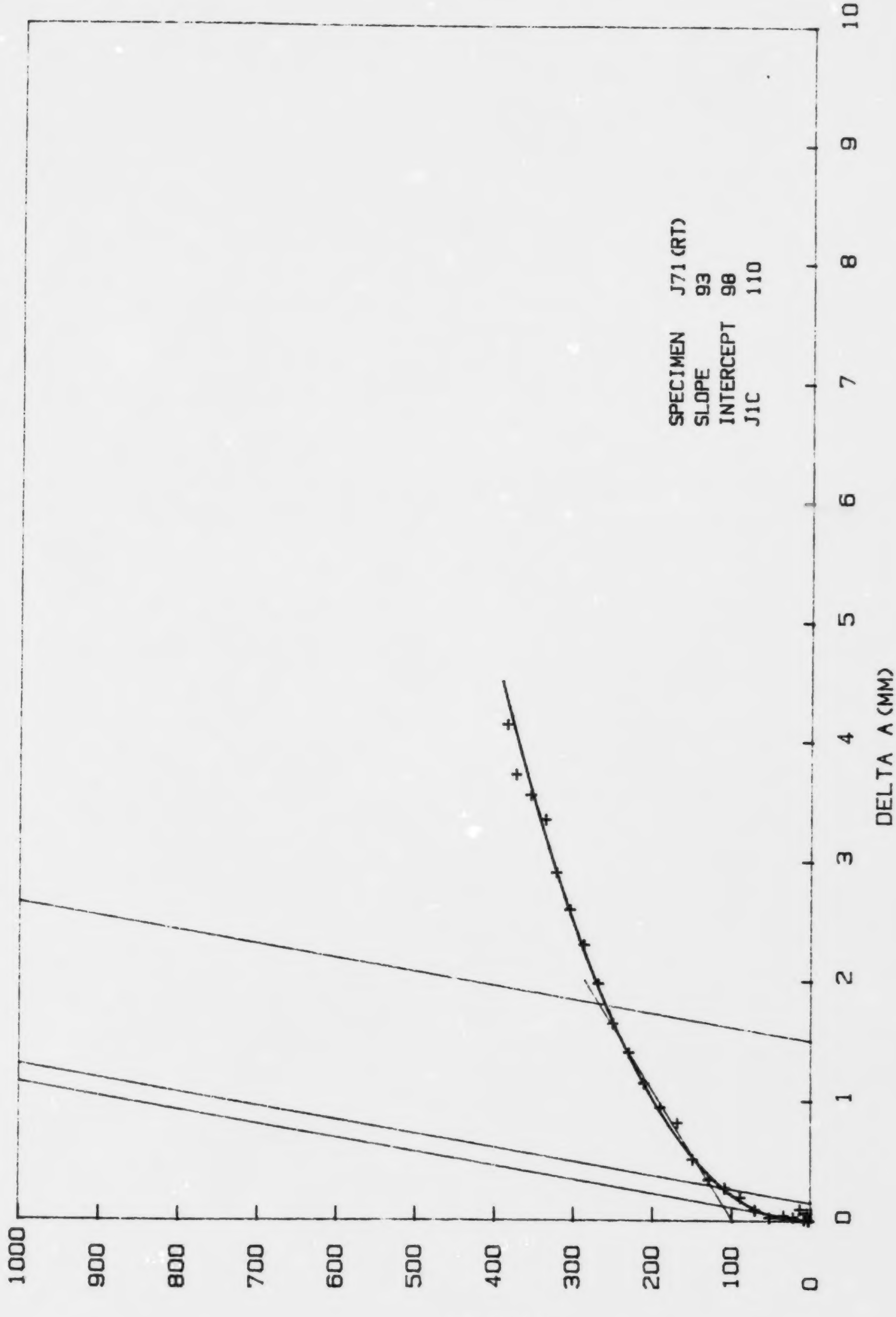
H(M)	D(M)	POISSON´S RATIO
.01426	2.54E-03	.3

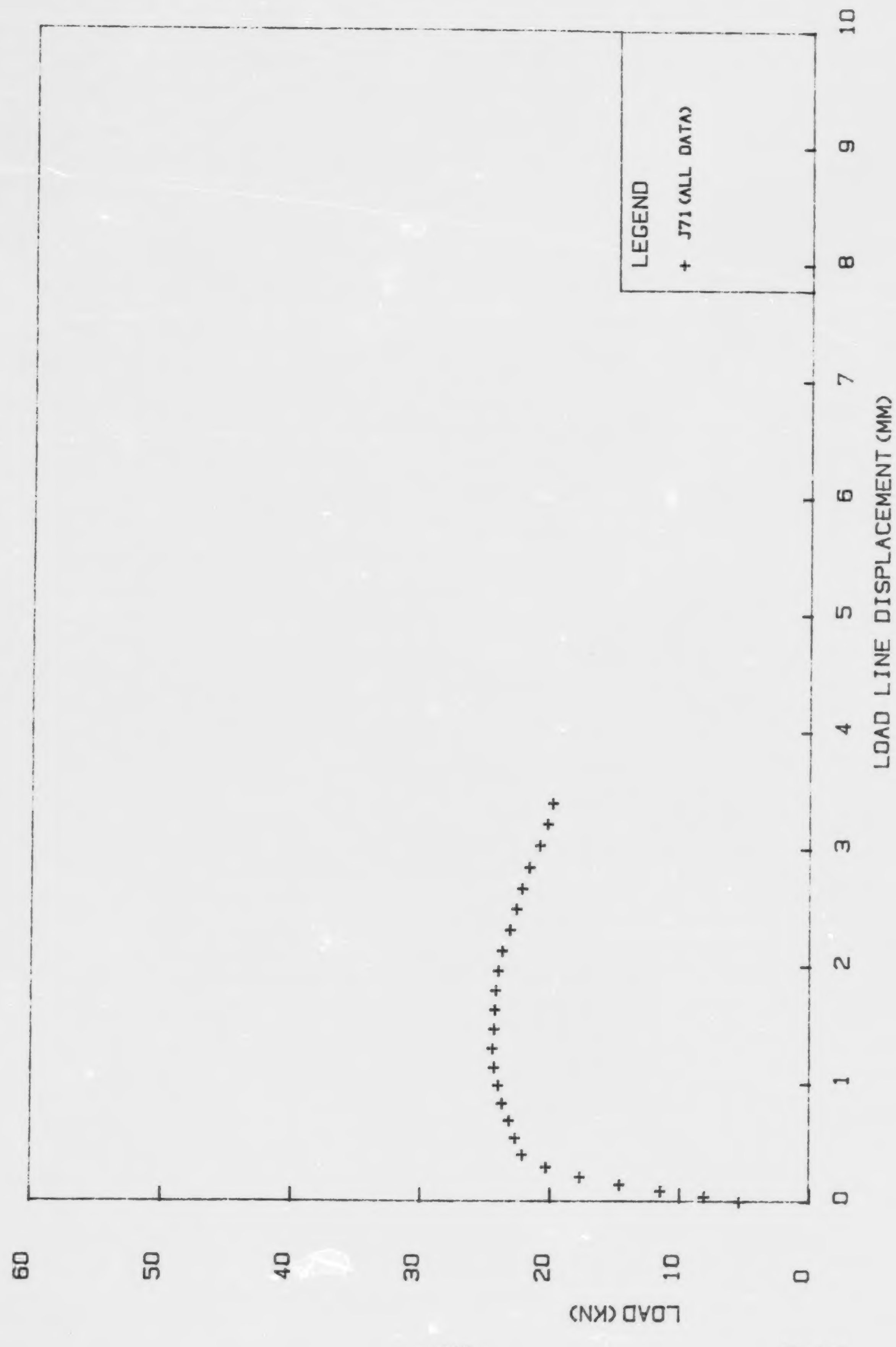
J70

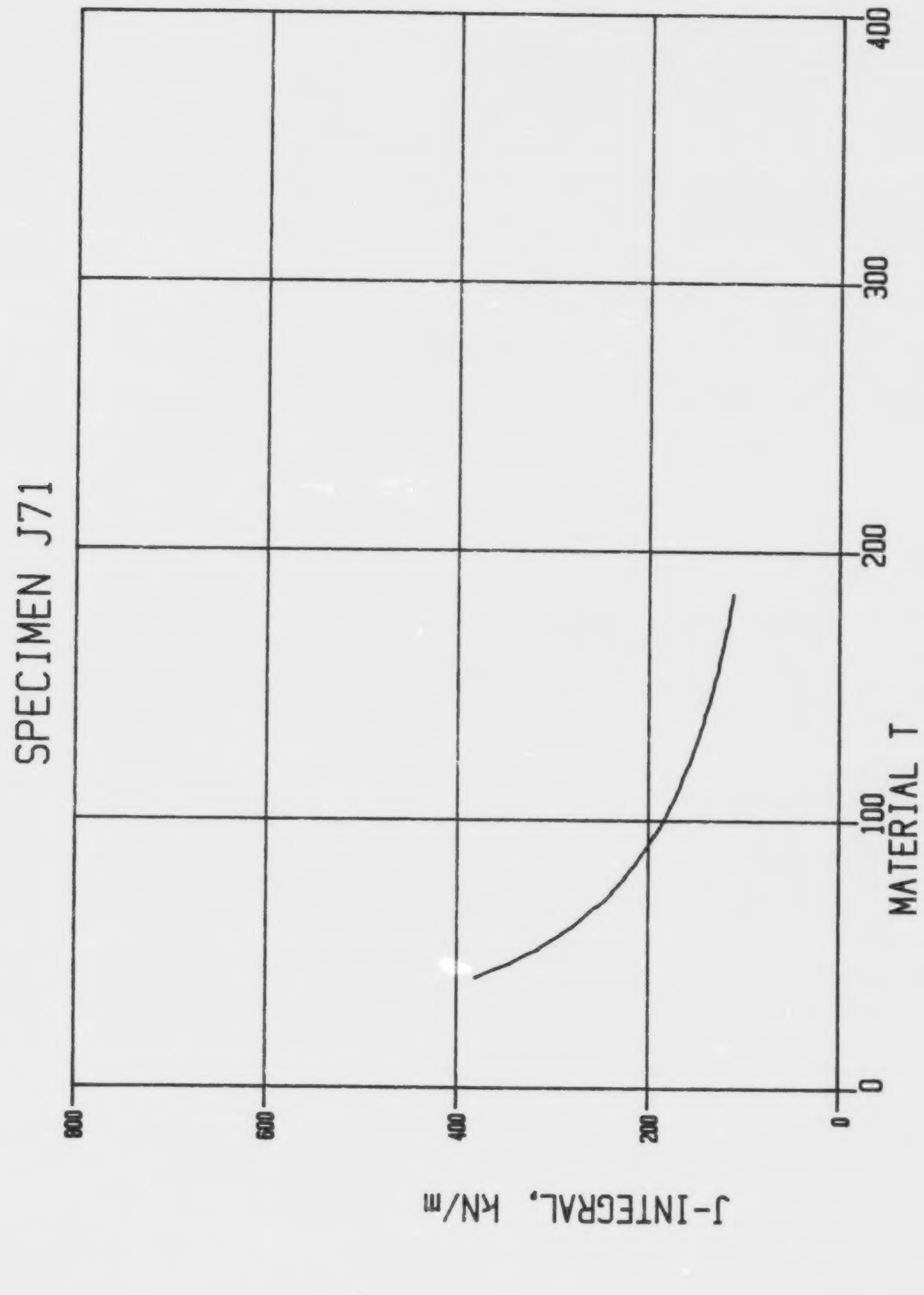
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.2	2.242	2.242	.05	.9996	1
3.45	2.243	2.243	.063	1	2
8.12	2.246	2.247	.098	.9999	3
16.59	2.245	2.247	.096	.9997	4
27.87	2.231	2.233	-.04	1	5
40.42	2.232	2.235	-.024	.9999	6
54.18	2.236	2.239	.024	.9999	7
69.21	2.232	2.237	-4E-03	.9998	8
85.03	2.238	2.244	.066	.9999	9
101.05	2.249	2.255	.182	.9999	10
118.06	2.257	2.265	.276	.9999	11
136.52	2.26	2.268	.308	.9999	12
153.64	2.281	2.29	.526	.9999	13
173.82	2.29	2.299	.624	.9998	14
193.76	2.301	2.312	.751	.9999	15
211.61	2.332	2.344	1.066	.9999	16
229.79	2.357	2.369	1.318	.9999	17
250.22	2.375	2.388	1.511	.9998	18
267.76	2.4	2.414	1.769	.9998	19
286.45	2.427	2.441	2.039	.9999	20
303.67	2.454	2.469	2.318	.9998	21
319.5	2.484	2.499	2.62	.9999	22
335.87	2.51	2.527	2.895	.9999	23
351.26	2.54	2.557	3.197	.9998	24
361.25	2.586	2.603	3.662	.9999	25

```
             LOAD(KN)       LOAD LINE DISPLACEMENT(MM)        J70
  1           1.855          0
  2           3.931           .037
  3           6.519           .085
  4           8.569           .154
  5           9.961           .253
  6           10.889          .366
  7           11.646          .487
  8           12.305          .613
  9           12.915          .74
  10          13.428          .873
  11          13.867          1.006
  12          14.258          1.141
  13          14.6            1.279
  14          14.795          1.422
  15          14.868          1.573
  16          14.966          1.726
  17          14.893          1.888
  18          14.819          2.046
  19          14.6            2.212
  20          14.502          2.372
  21          14.038          2.545
  22          13.696          2.716
  23          13.501          2.887
  24          13.208          3.059
  25          12.817          3.236
  26          11.987          3.428
```

	J(KN/M)	T	W	J70
1	127.29	694.22	68.63	
2	145.08	96.04	8.21	
3	163.73	253.88	19.11	
4	183.79	192.06	12.77	
5	202.69	69.23	4.09	
6	220.7	88.54	4.72	
7	240	129.06	6.24	
8	258.99	83.38	3.67	
9	277.11	84.55	3.41	
10	295.06	75.66	2.81	
11	311.59	64.1	2.2	
12	327.68	72.76	2.32	
13	343.56	62.47	1.86	
14	356.26	26.3	.73	


SPECIMEN J71 (RT)
SLOPE 93
INTERCEPT 98
J1C 110
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J71 (ALL DATA)


SPECIMEN J71
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J71
MATERIAL TYPE	A105 FORGING
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	311
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	561.7
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	2.54
PERCENT SIDE GROOVE	20.905
SPECIMEN WIDTH W(CM)	5.083
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.08488383E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.32
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.099

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.159
INITIAL A/W	.61
AVERAGE CRACK EXTENSION 9PT(CM)	.467
DELTA A(CM) COMPLIANCE	.414
MAX DEVIATION OF SINGLE MEASUREMENT %	.96

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	11
LAST POINT	17
JIC(KN/M)	110
CORRELATION COEFF	.99
SLOPE M(MPa)	93
INTERCEPT B (KN/M)	98

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	438.31
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	342.63
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.984
25*JQ/EF.Y.(CM)	.63

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	11
LAST DATA POINT USED	25
CONSTANT(C1)	198.79
EXPONENT(C2)	.4529

J71(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.63	2.42	.03	2.45	2.45	2.62	3.1	1
32.15	4.89	.02	4.91	4.91	5.24	3.106	2
40.86	7.9	.81	8.71	8.71	9.25	3.1	3
49.71	11.69	2.47	14.17	14.17	14.96	3.109	4
56.78	15.25	7.26	22.51	22.51	23.57	3.102	5
61.96	18.16	16.61	34.78	34.78	36.03	3.104	6
63.41	19.02	33.5	52.52	52.5	53.84	3.102	7
65.12	20.06	50.88	70.94	71.07	72.29	3.109	8
67.2	21.37	67.87	89.23	89.7	90.61	3.119	9
68.5	22.2	86.8	109	109.82	110.38	3.127	10
69.74	23.01	106.08	129.09	130.29	130.48	3.133	11
71.06	23.89	125.48	149.37	151.76	150.7	3.15	12
72.49	24.86	143.93	168.79	173.71	169.99	3.18	13
73.09	25.27	164.76	190.03	196.2	191.16	3.193	14
74.14	26	184.48	210.49	218.9	211.53	3.213	15
75.2	26.75	203.13	229.88	241.53	230.8	3.239	16
75.82	27.19	222.69	249.89	264.94	250.66	3.263	17
76.06	27.37	241.15	268.52	288.74	269.08	3.296	18
76.64	27.79	259.15	286.94	312.7	287.31	3.329	19
77.25	28.23	276.5	304.73	335.97	304.95	3.358	20
77.54	28.45	293.91	322.36	359.86	322.39	3.389	21
77.9	28.71	307.92	336.63	383.7	336.44	3.433	22
77.16	28.17	327.67	355.84	407.71	355.46	3.454	23
77.05	28.09	346.63	374.72	430.87	374.21	3.471	24
77.38	28.33	358.03	386.36	453.6	385.7	3.513	25

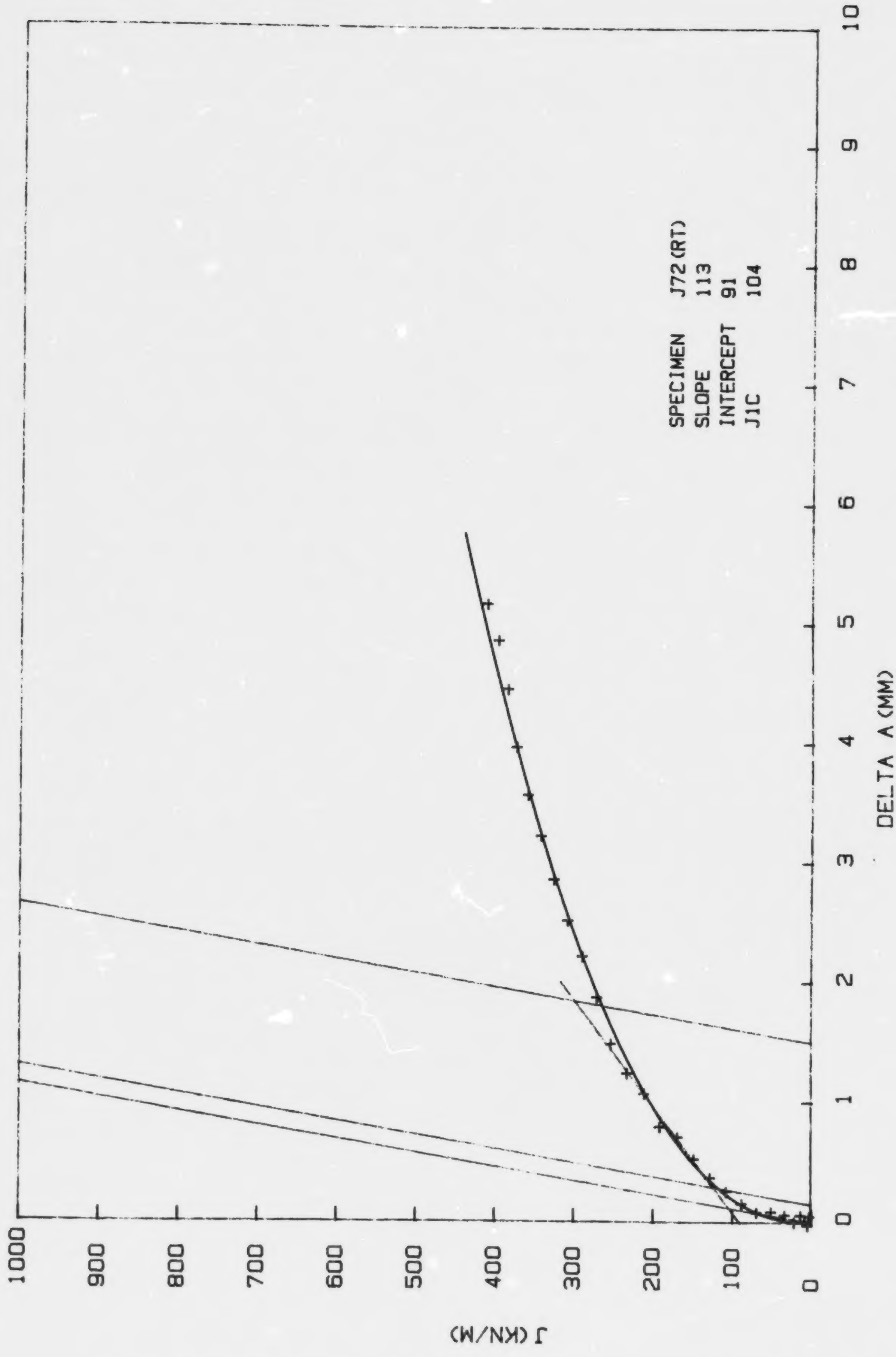
H(M)	D(M)	POISSON'S RATIO
.019	2.54E-03	.3

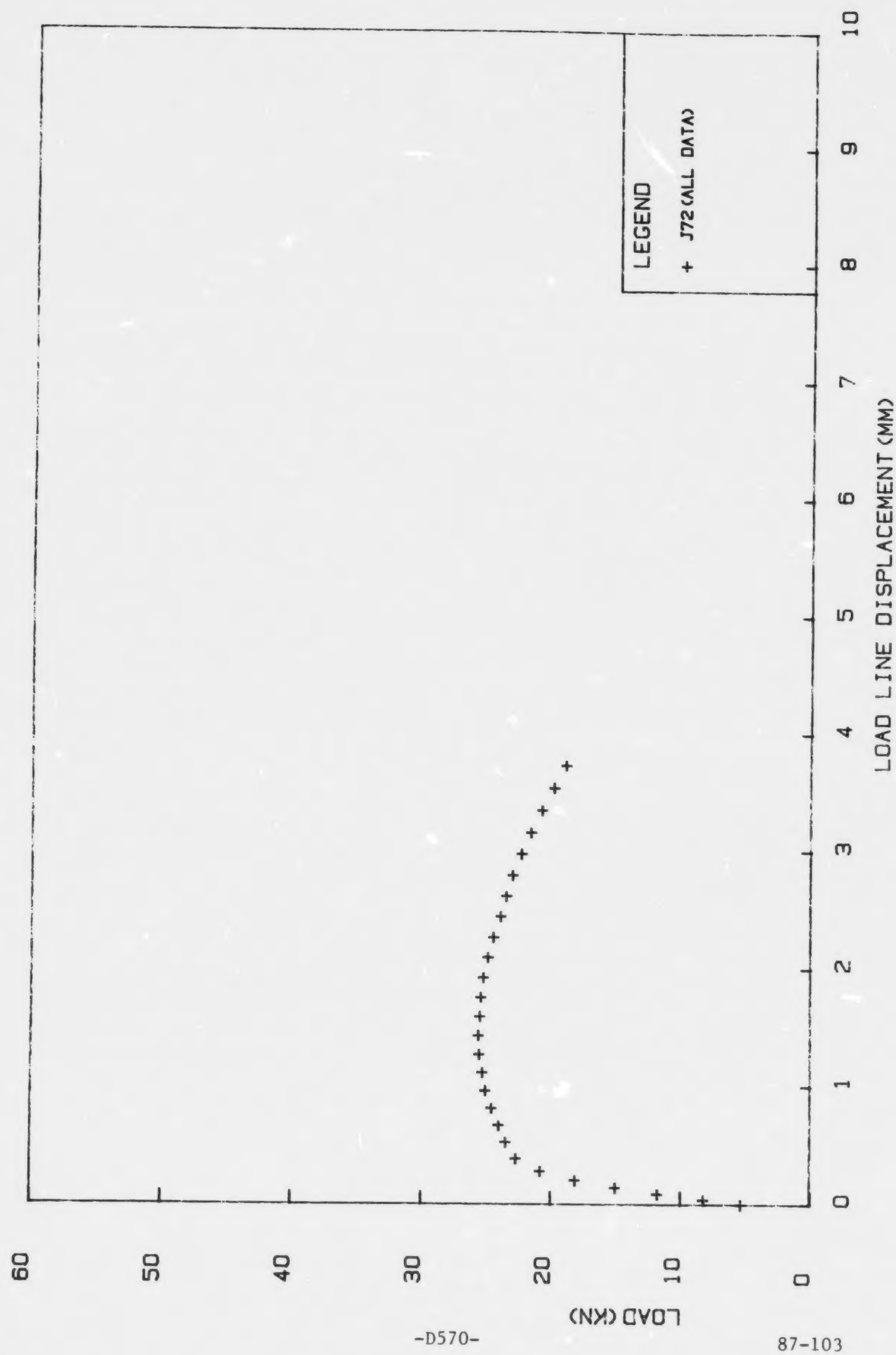
J71

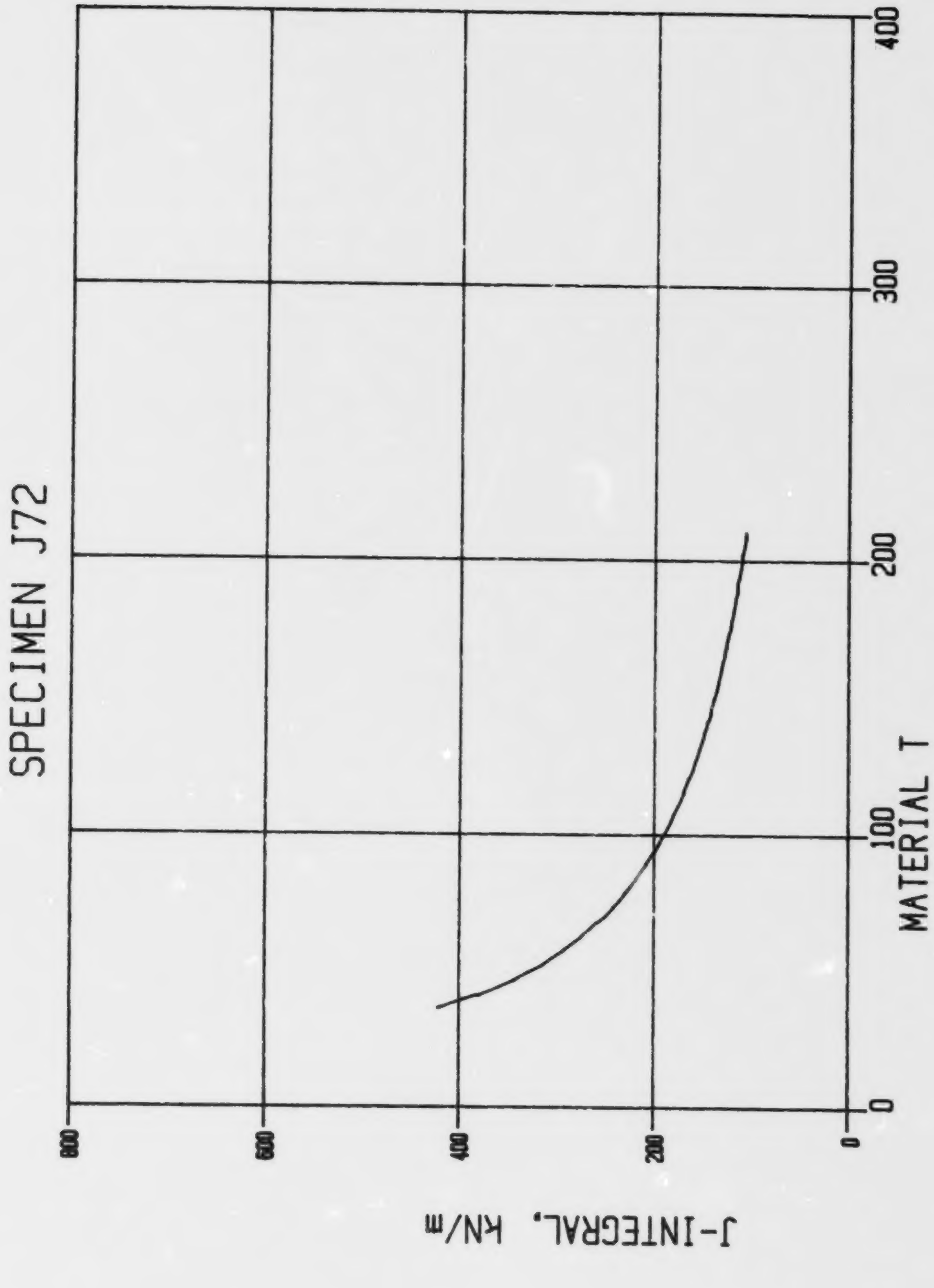
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.45	3.099	3.1	6E-03	.9998	1
4.91	3.105	3.106	.07	.9999	2
8.71	3.1	3.1	.014	.9999	3
14.17	3.108	3.109	.102	.9999	4
22.51	3.101	3.102	.034	1	5
34.78	3.102	3.104	.047	.9999	6
52.52	3.099	3.102	.03	.9999	7
70.94	3.105	3.109	.096	.9999	8
89.23	3.114	3.119	.198	.9999	9
109	3.121	3.127	.277	.9999	10
129.09	3.127	3.133	.344	.9999	11
149.37	3.143	3.15	.513	.9999	12
168.79	3.173	3.18	.815	.9999	13
190.03	3.185	3.193	.944	.9997	14
210.49	3.204	3.213	1.144	.9999	15
229.88	3.229	3.239	1.4	1	16
249.89	3.252	3.263	1.642	.9998	17
268.52	3.285	3.296	1.975	.9998	18
286.94	3.316	3.329	2.298	.9998	19
304.73	3.345	3.358	2.592	.9999	20
322.36	3.376	3.389	2.903	.9998	21
336.63	3.419	3.433	3.343	.9998	22
355.84	3.439	3.454	3.549	.9996	23
374.72	3.455	3.471	3.72	.9997	24
386.36	3.497	3.513	4.136	.9998	25

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J71
1	5.371	0	
2	8.118	.04	
3	11.475	.089	
4	14.648	.144	
5	17.7	.209	
6	20.325	.289	
7	22.156	.396	
8	22.705	.538	
9	23.193	.686	
10	23.743	.831	
11	24.048	.984	
12	24.353	1.136	
13	24.475	1.296	
14	24.353	1.461	
15	24.292	1.625	
16	24.231	1.791	
17	24.048	1.957	
18	23.743	2.128	
19	23.132	2.305	
20	22.644	2.484	
21	22.217	2.659	
22	21.667	2.839	
23	20.874	3.026	
24	20.264	3.209	
25	19.897	3.387	
26	19.165	3.573	

	J(KN/M)	T	W	J71
1	119.04	303.22	49.16	
2	139.23	121.04	16.63	
3	159.08	64.94	7.69	
4	179.41	166.05	17.31	
5	200.26	103.3	9.55	
6	220.18	76.49	6.34	
7	239.88	83.53	6.27	
8	259.2	56.63	3.86	
9	277.73	57.49	3.59	
10	295.84	61.13	3.53	
11	313.55	57.38	3.07	
12	329.49	32.76	1.62	
13	346.24	93.99	4.38	
14	365.28	111.47	4.87	
15	380.54	28.3	1.16	


SPECIMEN J72 (RT)
SLOPE 113
INTERCEPT 91
J1C 104
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J72 (ALL DATA)


SPECIMEN J72
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J72
 MATERIAL TYPE                                     A105 FORGING
 MATERIAL CONDITION                                PARENT
 TEST TEMPERATURE(DEG C)                           20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         311
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       561.7
 CRACK PLANE ORIENTATION (PER ASTM E399)           C-L
 SPECIMEN THICKNESS B(CM)                          2.54
 PERCENT SIDE GROOVE                               21.141
 SPECIMEN WIDTH W(CM)                              5.079
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.92346E+11
 EFFECTIVE MODULUS(Pa)                             2.08147769E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          23.61
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.058

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.122
 INITIAL A/W                                       .602
 AVERAGE CRACK EXTENSION 9PT(CM)                   .538
 DELTA A(CM) COMPLIANCE                            .515
 MAX DEVIATION OF SINGLE MEASUREMENT %             .56

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                   11
 LAST POINT                    17
 JIC(KN/M)                     104
 CORRELATION COEFF             .99
 SLOPE M(MPa)                  113
 INTERCEPT B (KN/M)            91

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          YES
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   437
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 328.47
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.021
 25*JQ/EF.Y.(CM)                                   .596

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      11
 LAST DATA POINT USED     27
 CONSTANT(C1)             204.2
 EXPONENT(C2)             .4405
```

J72(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
22.4	2.37	.01	2.38	2.38	2.53	3.063	1
31.85	4.8	.1	4.9	4.9	5.22	3.056	2
40.72	7.84	.66	8.51	8.51	9.03	3.06	3
49.33	11.51	2.34	13.85	13.86	14.62	3.064	4
56.38	15.04	6.97	22	22	23.03	3.058	5
61.8	18.07	15.93	34	34.02	35.2	3.064	6
64.08	19.43	31.83	51.26	51.31	52.55	3.067	7
65.55	20.33	49.48	69.81	69.85	71.16	3.066	8
67.44	21.52	67	88.52	88.79	89.91	3.074	9
69.32	22.74	85.54	108.27	108.98	109.68	3.084	10
70.62	23.6	104.96	128.56	129.89	129.95	3.095	11
72.2	24.66	124.25	148.91	151.32	150.27	3.111	12
73.43	25.51	144.1	169.61	173.5	170.91	3.129	13
73.6	25.63	166.31	191.93	196.66	193.17	3.138	14
75.07	26.67	185.04	211.7	219.43	212.84	3.165	15
75.6	27.04	206.33	233.37	243.23	234.4	3.182	16
76.06	27.37	226.76	254.13	267.44	255.02	3.207	17
77.26	28.24	243.51	271.75	291.04	272.46	3.245	18
77.81	28.64	261.59	290.23	315.29	290.75	3.279	19
78.48	29.14	279.67	308.81	339.4	309.18	3.309	20
79.26	29.72	296.6	326.32	363.73	326.52	3.343	21
79.59	29.97	312.89	342.86	388.12	342.86	3.38	22
79.52	29.92	329.55	359.47	412.64	359.26	3.414	23
79.4	29.82	344.38	374.2	437.27	373.78	3.454	24
79.62	29.99	355.74	385.73	461.46	385.13	3.502	25
79.19	29.67	368.26	397.93	485.02	397.13	3.543	26
78.87	29.43	382.72	412.15	508.25	411.17	3.573	27

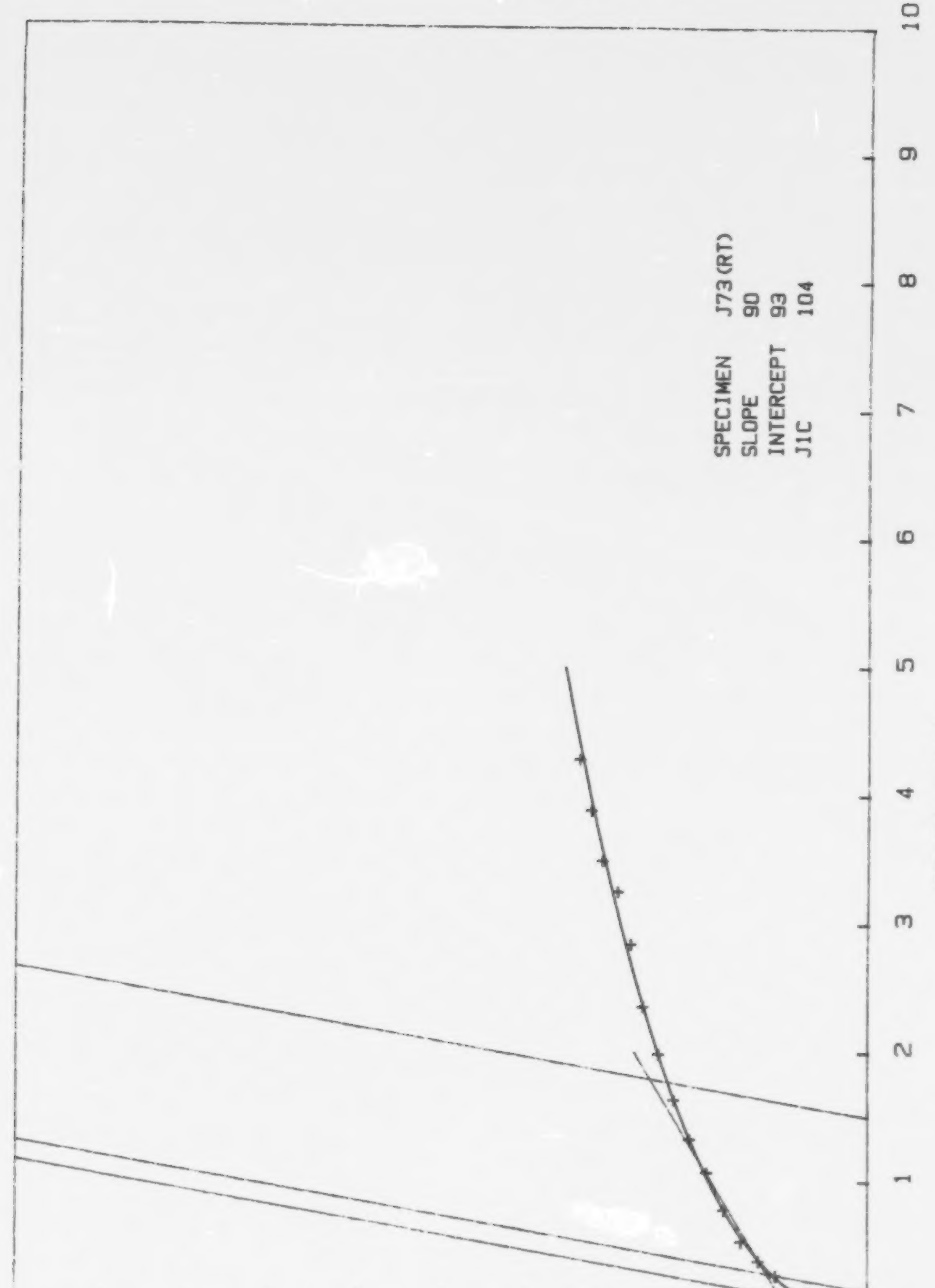
H(M)	D(M)	POISSON'S RATIO
.01903	2.54E-03	.3

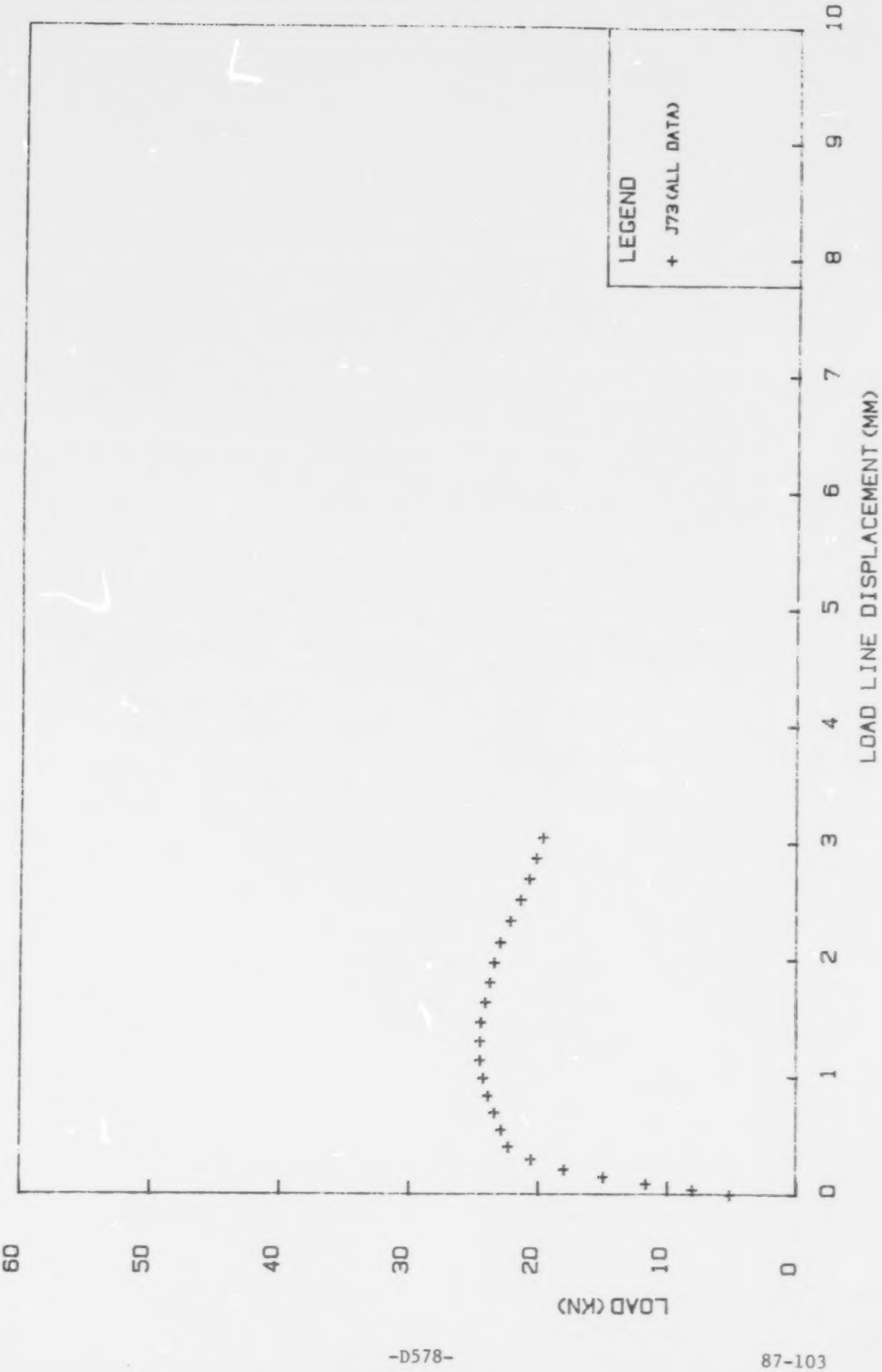
J72

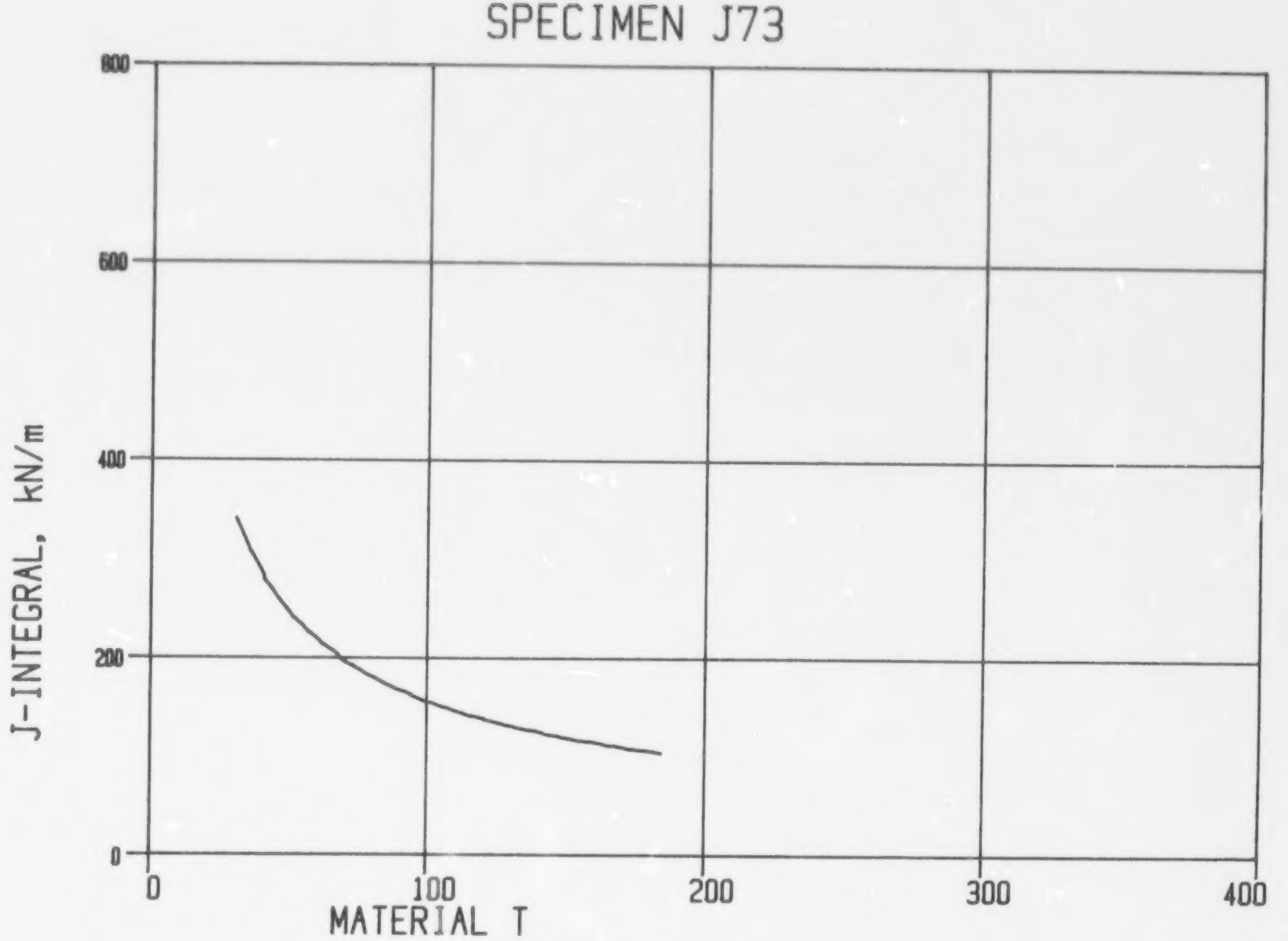
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.38	3.063	3.063	.051	.9999	1
4.9	3.055	3.056	-.021	.9999	2
8.51	3.059	3.06	.018	1	3
13.85	3.063	3.064	.062	.9999	4
22	3.057	3.058	3E-03	.9999	5
34	3.062	3.064	.064	.9999	6
51.26	3.064	3.067	.089	1	7
69.81	3.063	3.066	.084	.9999	8
88.52	3.069	3.074	.159	.9996	9
108.27	3.078	3.084	.258	.9998	10
128.56	3.089	3.095	.371	1	11
148.91	3.104	3.111	.528	.9998	12
169.61	3.121	3.129	.709	1	13
191.93	3.129	3.138	.796	.9998	14
211.7	3.155	3.165	1.068	.9997	15
233.37	3.171	3.182	1.239	.9998	16
254.13	3.195	3.207	1.486	.9996	17
271.75	3.233	3.245	1.872	.9999	18
290.23	3.267	3.279	2.213	.9998	19
308.81	3.296	3.309	2.513	.9998	20
326.32	3.329	3.343	2.854	.9997	21
342.86	3.365	3.38	3.219	.9998	22
359.47	3.399	3.414	3.561	.9999	23
374.2	3.439	3.454	3.961	.9997	24
385.73	3.486	3.502	4.442	.9993	25
397.93	3.527	3.543	4.85	.9998	26
412.15	3.557	3.573	5.155	.9992	27

```
              LOAD(KN)       LOAD LINE DISPLACEMENT(MM)      J72
    1          5.31            0
    2          8.24            .04
    3          11.78           .089
    4          15.015          .142
    5          18.127          .204
    6          20.813          .282
    7          22.705          .386
    8          23.499          .524
    9          24.048          .667
    10         24.597          .811
    11         25.085          .961
    12         25.33           1.113
    13         25.574          1.268
    14         25.635          1.427
    15         25.513          1.589
    16         25.452          1.753
    17         25.269          1.92
    18         24.902          2.092
    19         24.475          2.264
    20         23.926          2.44
    21         23.499          2.615
    22         23.01           2.793
    23         22.339          2.974
    24         21.606          3.157
    25         20.752          3.346
    26         19.836          3.539
    27         18.921          3.728
    28         18.25           3.915
```

	J(KN/M)	T	W	J72
1	98.4	200.4	40.22	
2	118.41	182.56	30.28	
3	138.73	130.9	18.38	
4	159.26	115.32	13.98	
5	180.77	258.6	27.49	
6	201.82	73.46	6.9	
7	222.53	127.7	10.78	
8	243.75	85.1	6.47	
9	262.94	46.05	3.18	
10	280.99	54.76	3.47	
11	299.52	62.71	3.67	
12	317.56	51.79	2.8	
13	334.59	45.82	2.3	
14	351.17	49.03	2.3	
15	366.84	37.17	1.63	
16	379.97	24.22	1	
17	391.83	30.26	1.17	
18	405.04	47.06	1.73	


SPECIMEN J73(RT)
SLOPE 90
INTERCEPT 93
J1C 104
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J73(ALL DATA)


SPECIMEN J73
J-INTEGRAL, kN/m
MATERIAL T
0
200
400
600
800
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J73
 MATERIAL TYPE                                        A105 FORGING
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            311
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          561.7
 CRACK PLANE ORIENTATION (PER ASTM E399)              C-L
 SPECIMEN THICKNESS B(CM)                             2.54
 PERCENT SIDE GROOVE                                  21.22
 SPECIMEN WIDTH W(CM)                                 5.077
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.0884917E+11

               FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             24.01
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.078

               CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.139
 INITIAL A/W                                          .606
 AVERAGE CRACK EXTENSION 9PT(CM)                      .466
 DELTA A(CM) COMPLIANCE                               .428
 MAX DEVIATION OF SINGLE MEASUREMENT %                .51

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    10
 LAST POINT                     15
 JIC(KN/M)                      104
 CORRELATION COEFF              .97
 SLOPE M(MPa)                   90
 INTERCEPT B (KN/M)             93

               VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

               QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      436.57
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    342.76
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.999
 25*JQ/EF.Y.(CM)                                      .596

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED      10
 LAST DATA POINT USED     23
 CONSTANT(C1)             187.41
 EXPONENT(C2)             .4006
```

J73(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.19	2.33	.02	2.35	2.35	2.51	3.078	1
32.2	4.9	.04	4.95	4.95	5.28	3.081	2
41.25	8.05	.8	8.86	8.86	9.42	3.08	3
49.68	11.68	2.81	14.49	14.49	15.3	3.08	4
56.73	15.23	7.98	23.21	23.21	24.27	3.079	5
61.52	17.91	17.87	35.77	35.76	37.03	3.077	6
63.38	19.01	34.44	53.45	53.52	54.74	3.084	7
65.28	20.16	51.51	71.67	71.9	73	3.092	8
66.51	20.93	69.9	90.83	90.98	92.22	3.089	9
68.41	22.14	87.57	109.71	110.61	111.09	3.106	10
69.72	23	106.56	129.56	131.1	130.92	3.117	11
70.56	23.55	126.6	150.15	152.74	151.45	3.132	12
71.81	24.39	145.52	169.91	174.56	171.1	3.156	13
72.45	24.83	165.05	189.88	197.34	190.9	3.185	14
72.9	25.14	184.86	210.01	220.34	210.87	3.211	15
73.88	25.82	202.73	228.55	242.78	229.26	3.241	16
74.6	26.33	220.33	246.66	265.85	247.17	3.277	17
74.42	26.21	238.5	264.71	289.64	264.97	3.314	18
75.02	26.62	252.7	279.33	312.56	279.37	3.362	19
75.5	26.97	267.58	294.55	335.34	294.39	3.403	20
75.2	26.75	285.72	312.48	358.05	312.14	3.427	21
76.26	27.51	298.11	325.62	379.7	325.16	3.466	22
75.66	27.08	312.51	339.58	402.77	338.88	3.506	23

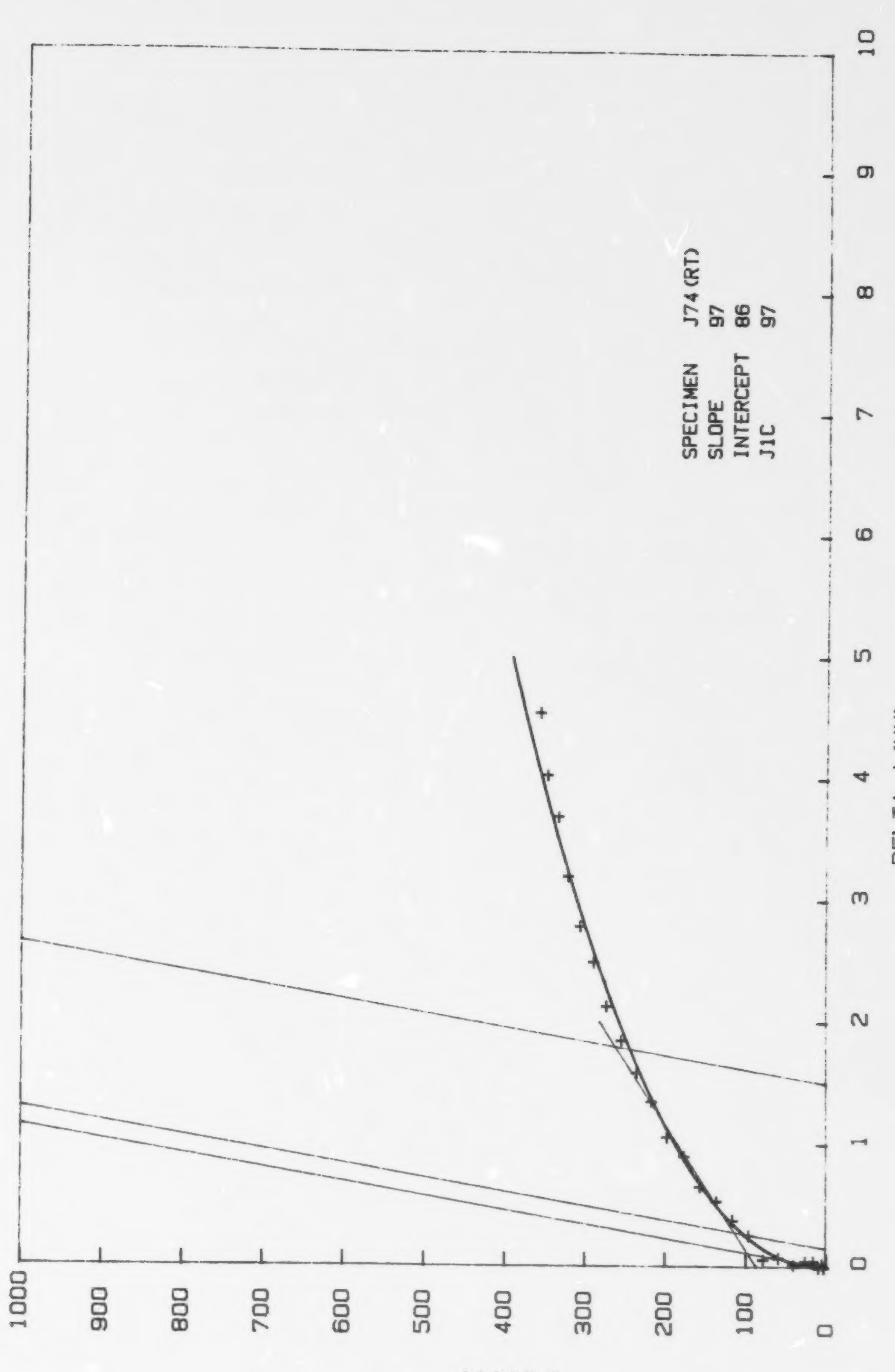
H(M)	D(M)	POISSON´S RATIO
.01905	2.54E-03	.3

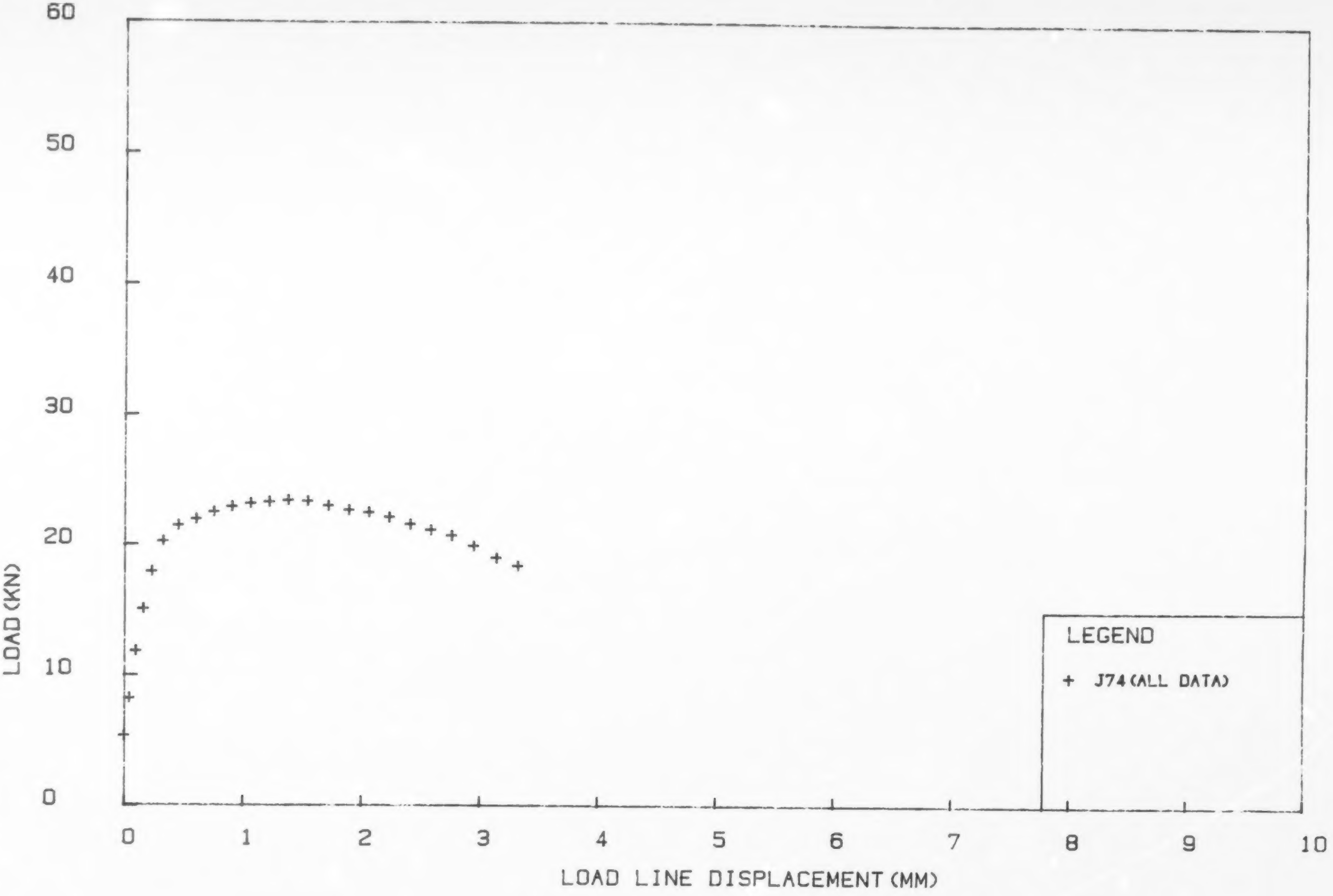
J73

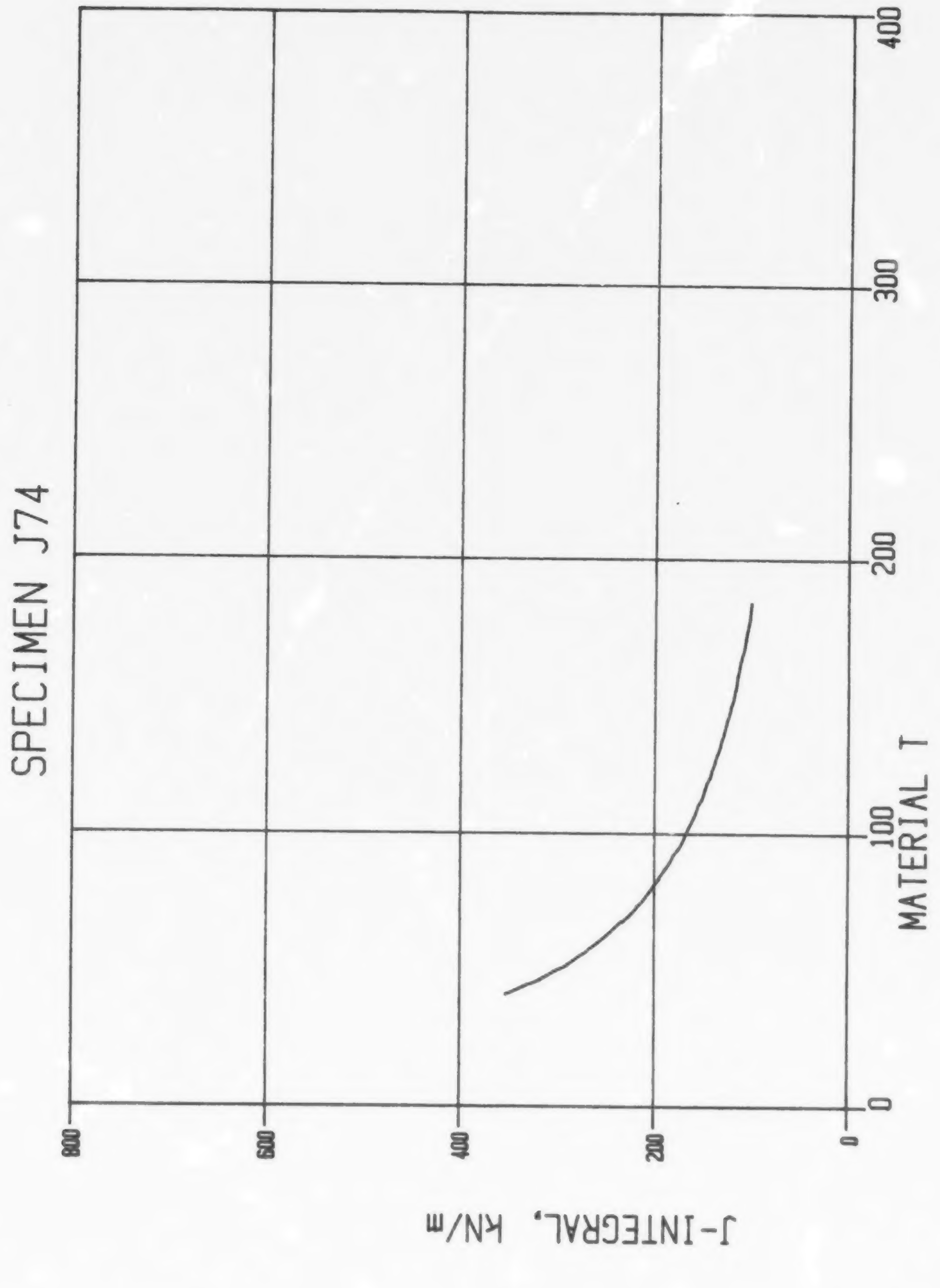
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.35	3.078	3.078	-2E-03	.9999	1
4.95	3.08	3.081	.029	.9999	2
8.86	3.079	3.08	.016	.9998	3
14.49	3.079	3.08	.018	.9999	4
23.21	3.078	3.079	.013	.9999	5
35.77	3.075	3.077	-6E-03	.9999	6
53.45	3.081	3.084	.064	.9999	7
71.67	3.088	3.092	.136	.9999	8
90.83	3.085	3.089	.113	.9999	9
109.71	3.1	3.106	.276	.9999	10
129.56	3.11	3.117	.389	.9999	11
150.15	3.124	3.132	.536	.9999	12
169.91	3.148	3.156	.782	1	13
189.88	3.176	3.185	1.071	.9998	14
210.01	3.201	3.211	1.327	.9998	15
228.55	3.231	3.241	1.634	.9997	16
246.66	3.266	3.277	1.987	.9999	17
264.71	3.302	3.314	2.357	.9999	18
279.33	3.35	3.362	2.842	.9998	19
294.55	3.39	3.403	3.25	.9996	20
312.48	3.413	3.427	3.489	.9997	21
325.62	3.452	3.466	3.883	.9998	22
339.58	3.492	3.506	4.279	.9997	23

```
          LOAD(KN)     LOAD LINE DISPLACEMENT(MM)      J73
 1         5.127        0
 2         8.057         .042
 3        11.658         .093
 4        14.954         .149
 5        18.005         .214
 6        20.569         .298
 7        22.339         .405
 8        22.888         .549
 9        23.438         .695
 10       23.926         .84
 11       24.292         .99
 12       24.536        1.143
 13       24.536        1.302
 14       24.475        1.465
 15       24.109        1.635
 16       23.743        1.805
 17       23.438        1.974
 18       22.949        2.148
 19       22.156        2.33
 20       21.362        2.512
 21       20.691        2.693
 22       20.142        2.87
 23       19.653        3.046
 24       18.738        3.235
```

	J(KN/M)	T	W	J73
1	100.27	117.03	22.78	
2	119.63	178.45	28.94	
3	139.85	141	19.42	
4	160.03	81.23	9.65	
5	179.89	69.79	7.27	
6	199.94	79.32	7.33	
7	219.28	61.01	5.06	
8	237.6	51.8	3.89	
9	255.68	49.39	3.37	
10	272.02	30.41	1.9	
11	286.94	37.7	2.18	
12	303.51	75.68	4.07	
13	319.05	33.75	1.69	
14	332.6	35.56	1.66	


SPECIMEN J74 (RT)
SLOPE 97
INTERCEPT 86
J1C 97
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J74 (ALL DATA)


SPECIMEN J74
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J74
MATERIAL TYPE	A105 FORGING
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	311
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	561.7
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	2.542
PERCENT SIDE GROOVE	21.872
SPECIMEN WIDTH W(CM)	5.079
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.10520278E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	24.89
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.126

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.192
INITIAL A/W	.615
AVERAGE CRACK EXTENSION 9PT(CM)	.477
DELTA A(CM) COMPLIANCE	.454
MAX DEVIATION OF SINGLE MEASUREMENT %	.85

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	10
LAST POINT	16
JIC(KN/M)	97
CORRELATION COEFF	.98
SLOPE M(MPa)	97
INTERCEPT B (KN/M)	86

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	433.3
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	326.94
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	1.953
25*JQ/EF.Y.(CM)	.556

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	10
LAST DATA POINT USED	24
CONSTANT(C1)	187.84
EXPONENT(C2)	.4592

J74(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
23.63	2.64	.02	2.66	2.66	2.86	3.126	1
34.05	5.48	.01	5.5	5.5	5.91	3.129	2
43.23	8.84	1.09	9.93	9.93	10.6	3.125	3
51.69	12.64	3.58	16.22	16.23	17.16	3.131	4
58.37	16.12	10.19	26.31	26.31	27.51	3.131	5
61.72	18.02	23.28	41.31	41.29	42.67	3.128	6
63.42	19.03	40.68	59.71	59.78	61.11	3.133	7
64.93	19.95	58.63	78.58	78.61	80.06	3.132	8
67.22	21.38	75.51	96.89	97.68	98.34	3.152	9
68.64	22.29	94.49	116.78	118.2	118.21	3.164	10
69.87	23.1	113.45	136.55	138.94	137.94	3.179	11
70.94	23.81	133.24	157.05	160.35	158.4	3.191	12
72.25	24.7	151.82	176.51	182.06	177.76	3.216	13
72.09	24.59	173.85	198.44	205.64	199.54	3.232	14
72.94	25.17	192.45	217.62	228.3	218.56	3.261	15
73.87	25.82	210.8	236.62	250.51	237.45	3.285	16
74.4	26.19	229.47	255.66	273.47	256.33	3.311	17
74.43	26.21	248.05	274.26	296.7	274.73	3.339	18
75.44	26.93	263.38	290.31	319.26	290.62	3.375	19
75.99	27.32	279.9	307.22	341.85	307.37	3.405	20
76.05	27.36	294.69	322.05	365.3	321.97	3.446	21
76.16	27.44	306.89	334.34	388.55	334.04	3.495	22
76.35	27.58	320.77	348.34	410.8	347.87	3.529	23
76.57	27.74	329.9	357.64	433.18	357.01	3.58	24

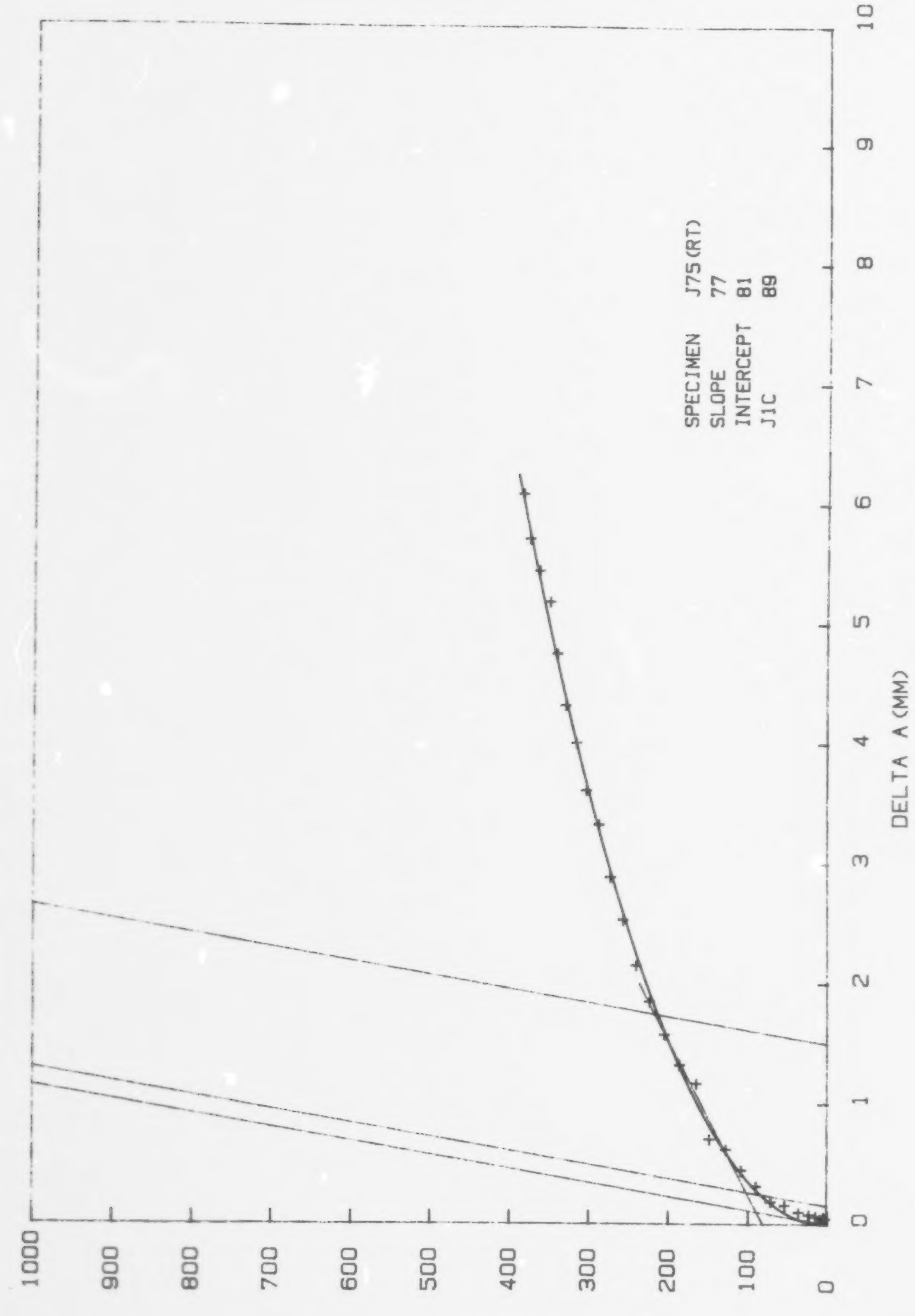
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

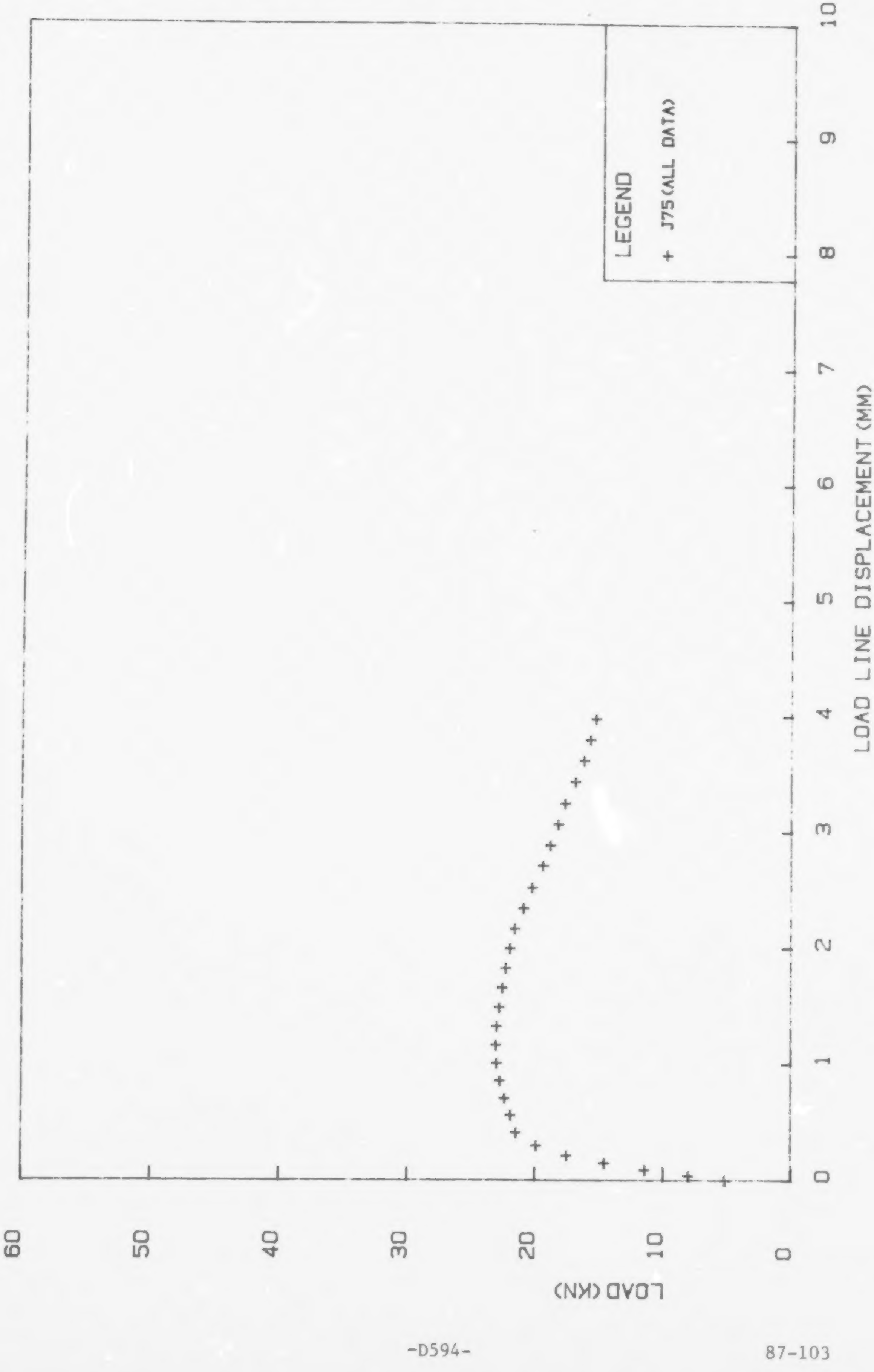
J74

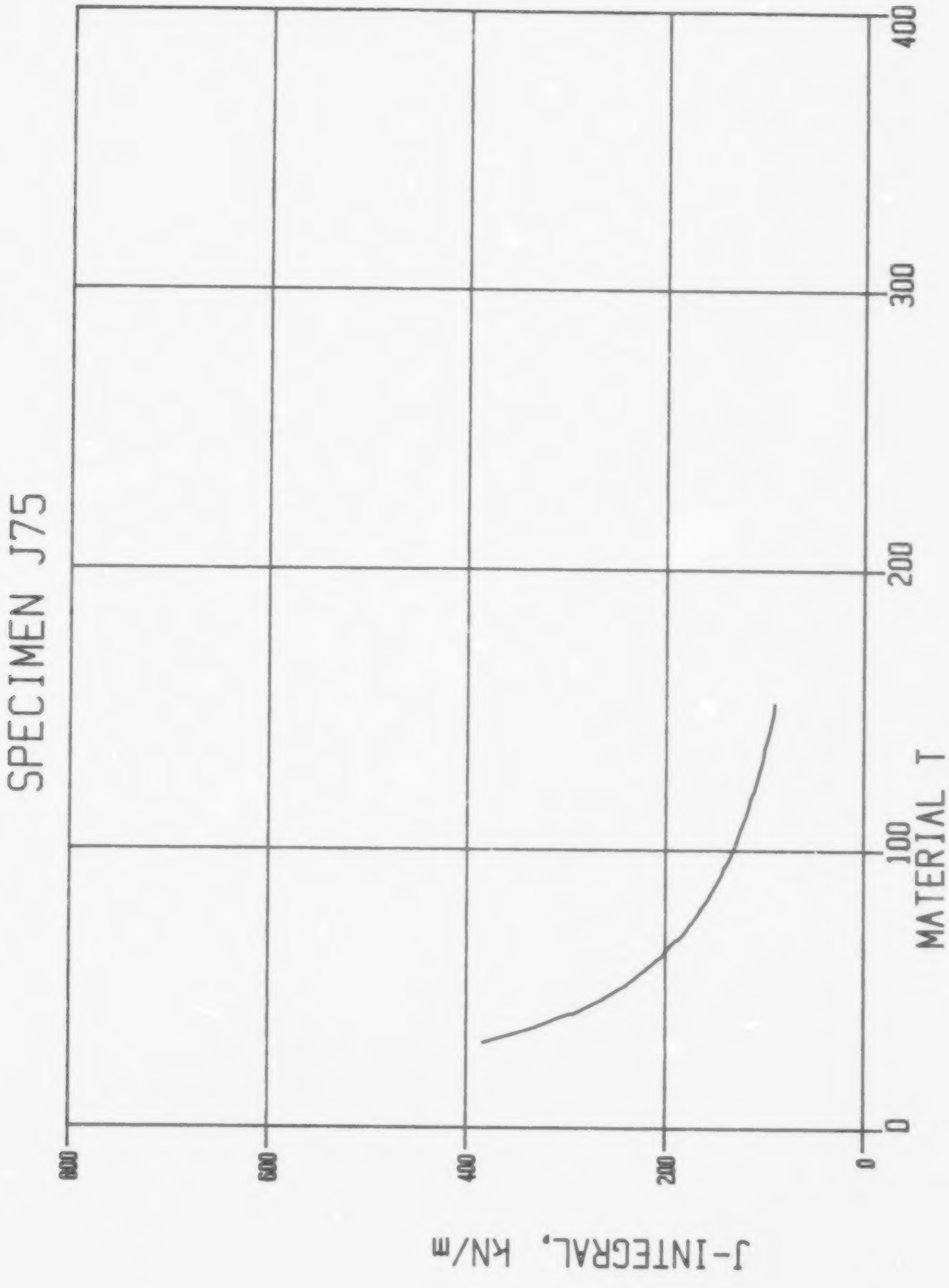
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.66	3.125	3.126	-4E-03	.9998	1
5.5	3.128	3.129	.027	.9999	2
9.93	3.125	3.125	-6E-03	.9998	3
16.22	3.13	3.131	.05	.999	4
26.31	3.129	3.131	.05	.9998	5
41.31	3.125	3.128	.017	.9995	6
59.71	3.13	3.133	.075	.9999	7
78.58	3.128	3.132	.06	.9998	8
96.89	3.147	3.152	.256	.9998	9
116.78	3.158	3.164	.381	.9999	10
136.55	3.173	3.179	.533	1	11
157.05	3.184	3.191	.653	.9999	12
176.51	3.208	3.216	.901	.9998	13
198.44	3.223	3.232	1.059	.9999	14
217.62	3.251	3.261	1.349	.9999	15
236.62	3.274	3.285	1.587	.9999	16
255.66	3.3	3.311	1.85	.9998	17
274.26	3.327	3.339	2.132	.9998	18
290.31	3.363	3.375	2.494	.9997	19
307.22	3.392	3.405	2.787	.9998	20
322.05	3.432	3.446	3.2	.9998	21
334.34	3.481	3.495	3.688	.9996	22
348.34	3.515	3.529	4.032	.9993	23
357.64	3.566	3.58	4.545	.9996	24

```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)       J74
 1          5.31          0
 2          8.24          .044
 3          11.841        .098
 4          15.076        .159
 5          17.944        .229
 6          20.264        .325
 7          21.484        .452
 8          21.973        .603
 9          22.522        .752
 10         22.949        .903
 11         23.193        1.061
 12         23.315        1.218
 13         23.438        1.378
 14         23.376        1.542
 15         23.01         1.716
 16         22.705        1.888
 17         22.522        2.056
 18         22.156        2.229
 19         21.606        2.406
 20         21.179        2.582
 21         20.752        2.756
 22         19.958        2.943
 23         19.043        3.135
 24         18.433        3.317
 25         17.517        3.51
```

	J(KN/M)	T	W	J74
1	106.83	161.61	28.67	
2	126.66	130.79	19.42	
3	146.8	173.69	22.11	
4	166.78	79.25	8.76	
5	187.47	139.63	13.62	
6	208.03	66.85	5.78	
7	227.12	80.76	6.32	
8	246.14	73.04	5.19	
9	264.96	66.6	4.33	
10	282.28	44.78	2.68	
11	298.76	58.36	3.24	
12	314.63	36.3	1.86	
13	328.19	25.42	1.21	
14	341.34	41.18	1.85	
15	352.99	18.3	.77	


SPECIMEN J75(RT)
SLOPE 77
INTERCEPT 81
J1C 89
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ J75 (ALL DATA)


SPECIMEN J75
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

SPECIMEN NUMBER                                      J75
MATERIAL TYPE                                        A105 FORGING
MATERIAL CONDITION                                   PARENT
TEST TEMPERATURE(DEG C)                              20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            311
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          561.7
CRACK PLANE ORIENTATION (PER ASTM E399)              C-L
SPECIMEN THICKNESS B(CM)                             2.54
PERCENT SIDE GROOVE                                  21.102
SPECIMEN WIDTH W(CM)                                 5.084
YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
EFFECTIVE MODULUS(Pa)                                2.10268622E+11

                FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             24.75
INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.122

                CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                       3.192
INITIAL A/W                                          .614
AVERAGE CRACK EXTENSION 9PT(CM)                      .61
DELTA A(CM) COMPLIANCE                               .608
MAX DEVIATION OF SINGLE MEASUREMENT %                1.18

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                   10
LAST POINT                    16
JIC(KN/M)                     89
CORRELATION COEFF             .97
SLOPE M(MPa)                  77
INTERCEPT B (KN/M)            81

                VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD      YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD         YES

                QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                             YES
CRACK SIZE DA<0.15*DELTA A                           YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      437.22
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    295.33
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     1.962
25*JQ/EF.Y.(CM)                                      .51

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED        10
LAST DATA POINT USED       28
CONSTANT(C1)               163.83
EXPONENT(C2)               .4762
```

J75(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.78	2.46	-.01	2.44	2.44	2.61	3.126	1
32.56	5.02	.03	5.05	5.05	5.39	3.128	2
41.55	8.17	.85	9.02	9.02	9.59	3.126	3
49.99	11.83	2.85	14.68	14.68	15.5	3.128	4
56.86	15.29	8.09	23.38	23.39	24.45	3.13	5
61.5	17.9	18.32	36.21	36.23	37.46	3.132	6
63	18.78	35.09	53.86	53.95	55.14	3.137	7
64.56	19.72	52.1	71.82	71.97	73.14	3.141	8
66.31	20.81	69.37	90.18	90.78	91.49	3.153	9
67.75	21.72	87.35	109.07	110.28	110.36	3.167	10
68.9	22.46	105.59	128.05	130.27	129.28	3.184	11
69.23	22.67	126.09	148.77	151.61	149.94	3.193	12
71.41	24.13	140.99	165.11	171.91	166.12	3.239	13
71.58	24.24	161.79	186.03	194.32	186.93	3.254	14
72.4	24.8	180.24	205.03	216.19	205.79	3.28	15
72.96	25.19	198.48	223.67	238.3	224.26	3.307	16
73.74	25.73	215.42	241.14	260.07	241.57	3.337	17
73.98	25.9	231.83	257.72	282.54	257.93	3.375	18
74.04	25.93	248.01	273.95	304.79	273.93	3.411	19
73.98	25.89	262.69	288.58	327.55	288.32	3.454	20
73.95	25.87	278.59	304.46	349.16	304.01	3.483	21
74.48	26.24	290.97	317.21	370.46	316.6	3.523	22
74.61	26.33	304.95	331.29	391.72	330.52	3.554	23
74.6	26.33	315.61	341.94	412.94	341	3.597	24
75.11	26.69	324.66	351.35	433.57	350.3	3.64	25
74.99	26.6	338.1	364.7	454	363.51	3.666	26
75.2	26.75	350.36	377.12	474.11	375.81	3.693	27
75.75	27.15	358.28	385.43	493.83	384.05	3.73	28

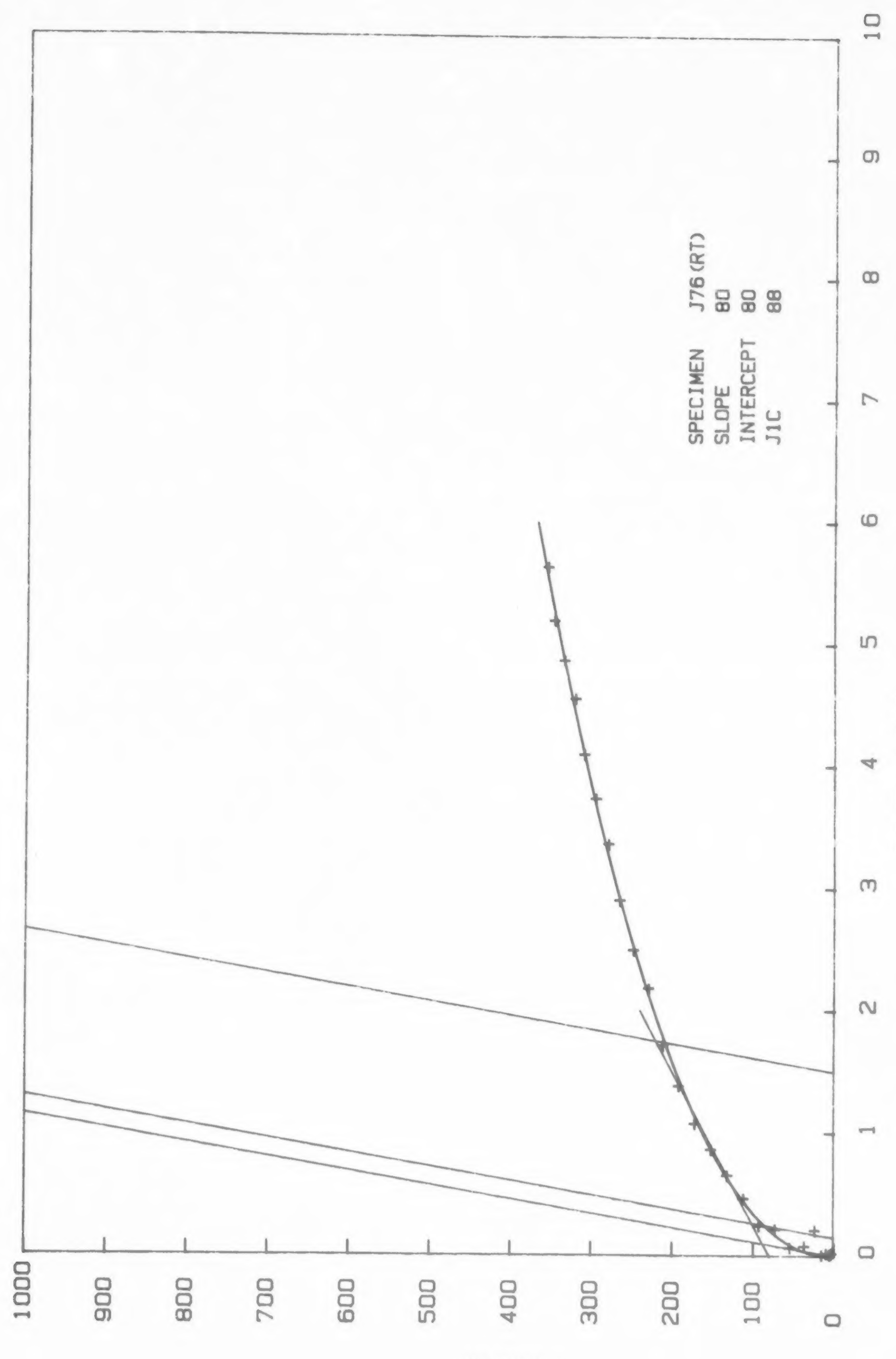
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

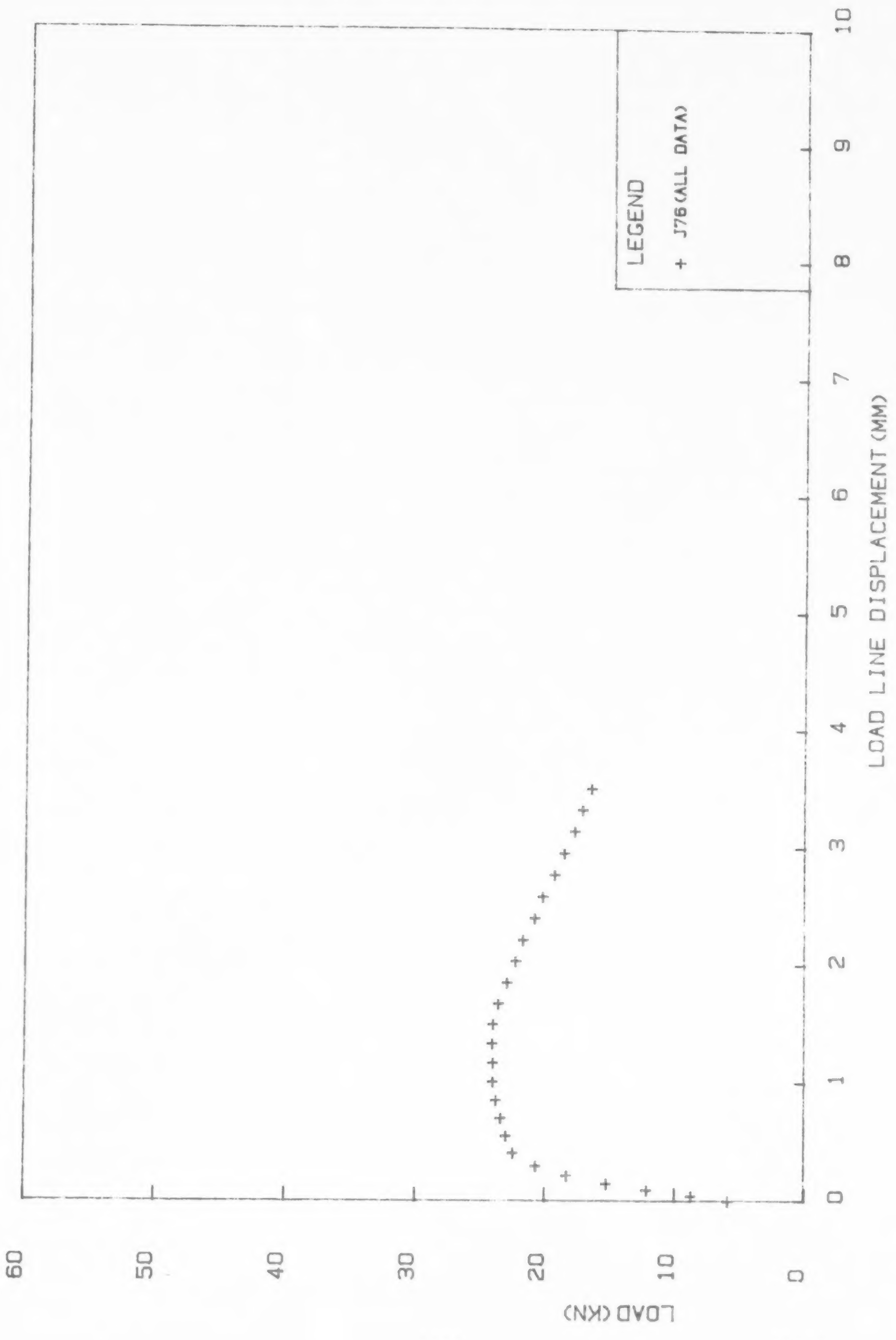
J75

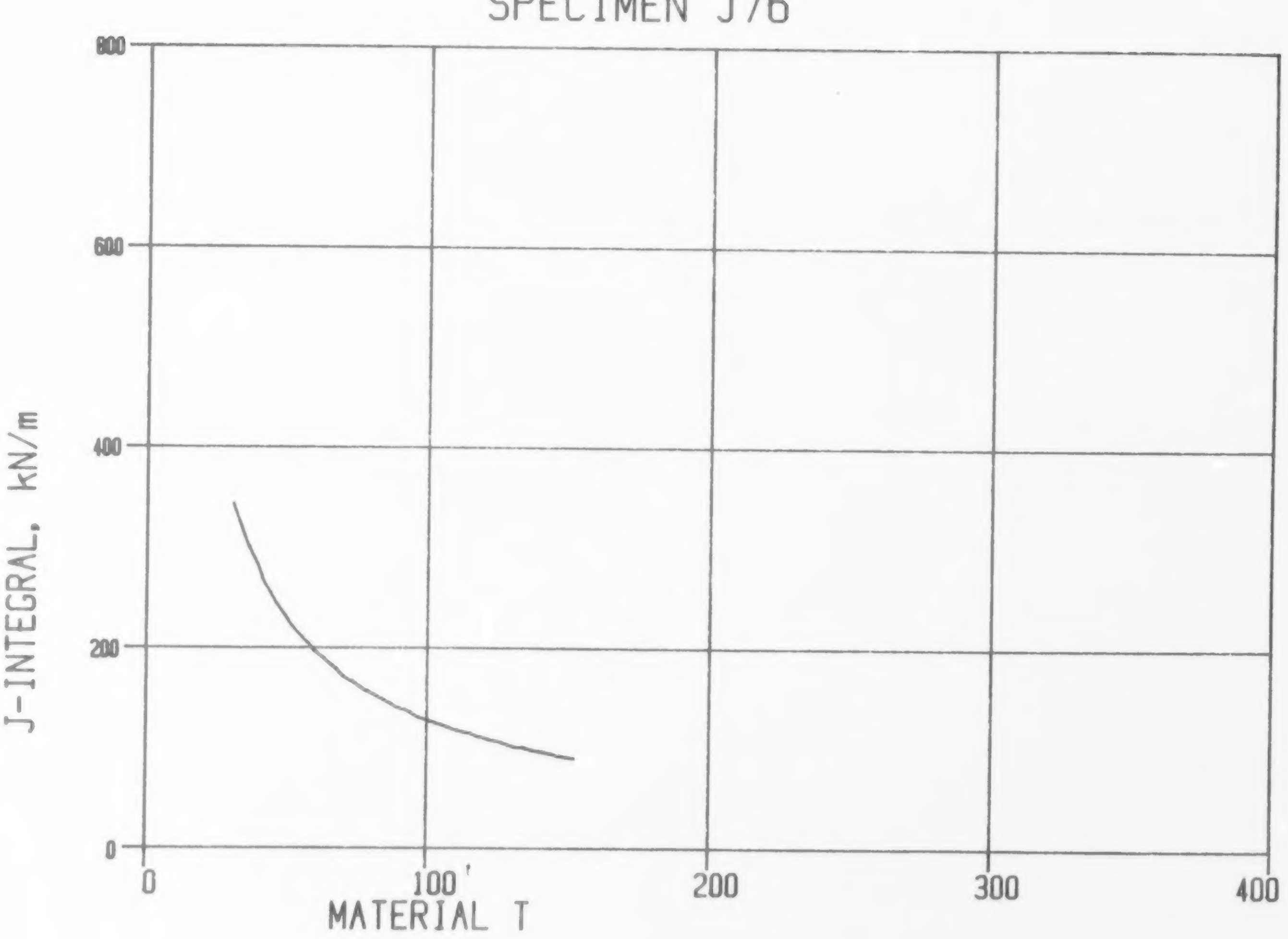
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.44	3.126	3.126	.044	.9998	1
5.05	3.127	3.128	.059	1	2
9.02	3.125	3.126	.039	1	3
14.68	3.127	3.128	.063	1	4
23.38	3.128	3.13	.079	.9999	5
36.21	3.13	3.132	.101	.9999	6
53.86	3.134	3.137	.155	.9999	7
71.82	3.137	3.141	.185	.9999	8
90.18	3.149	3.153	.315	.9999	9
109.07	3.161	3.167	.447	.9999	10
128.05	3.178	3.184	.618	.9999	11
148.77	3.186	3.193	.706	.9997	12
165.11	3.231	3.239	1.168	1	13
186.03	3.246	3.254	1.321	.9999	14
205.03	3.27	3.28	1.576	.9998	15
223.67	3.297	3.307	1.85	.9998	16
241.14	3.327	3.337	2.153	.9999	17
257.72	3.364	3.375	2.532	.9998	18
273.95	3.399	3.411	2.986	.9997	19
288.58	3.442	3.454	3.325	.9997	20
304.46	3.47	3.483	3.611	.9993	21
317.21	3.509	3.523	4.007	.9997	22
331.29	3.54	3.554	4.319	.9996	23
341.94	3.583	3.597	4.751	.9995	24
351.35	3.626	3.64	5.184	.9998	25
364.7	3.651	3.666	5.442	.9996	26
377.12	3.677	3.693	5.709	.9996	27
385.43	3.715	3.73	6.084	.9996	28

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J75
1	5.127	0	
2	7.996	.042	
3	11.414	.093	
4	14.587	.15	
5	17.517	.216	
6	19.897	.302	
7	21.484	.414	
8	21.912	.56	
9	22.4	.706	
10	22.766	.856	
11	23.01	1.008	
12	23.071	1.163	
13	23.01	1.326	
14	22.827	1.488	
15	22.583	1.658	
16	22.339	1.826	
17	21.973	1.997	
18	21.606	2.167	
19	20.935	2.345	
20	20.264	2.523	
21	19.409	2.711	
22	18.86	2.888	
23	18.25	3.069	
24	17.7	3.248	
25	16.907	3.435	
26	16.235	3.621	
27	15.747	3.8	
28	15.32	3.979	
29	14.771	4.163	

	J(KN/M)	T	W	J75
1	81	142.83	33.7	
2	99.62	144.74	27.57	
3	118.56	111.7	17.72	
4	138.41	238.11	32.21	
5	156.94	35.78	4.16	
6	175.57	138.09	14.25	
7	195.53	75.36	6.88	
8	214.35	68.68	5.64	
9	232.41	58.11	4.32	
10	249.43	44.22	3	
11	265.84	46.29	2.88	
12	281.27	33.72	1.93	
13	296.52	56.08	3	
14	310.84	32.5	1.62	
15	324.25	45.54	2.13	
16	336.61	24.92	1.09	
17	346.64	21.96	.91	
18	358.02	52.18	2.05	
19	370.91	47.1	1.75	
20	381.27	22.39	.79	


SPECIMEN J76(RT)
SLOPE 80
INTERCEPT 80
J1C 88
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ J76 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J76
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

```
     DATA SHEET-J1-R CURVE TEST

                TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J76
 MATERIAL TYPE                                        A105 FORGING
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            311
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          561.7
 CRACK PLANE ORIENTATION (PER ASTM E399)              C-L
 SPECIMEN THICKNESS B(CM)                             2.54
 PERCENT SIDE GROOVE                                  21.102
 SPECIMEN WIDTH W(CM)                                 5.085
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.10791256E+11

                FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             24.07
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.087

                CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.158
 INITIAL A/W                                          .607
 AVERAGE CRACK EXTENSION 9PT(CM)                      .599
 DELTA A(CM) COMPLIANCE                               .563
 MAX DEVIATION OF SINGLE MEASUREMENT %                .95

                ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                       10
 LAST POINT                        15
 JIC(KN/M)                         88
 CORRELATION COEFF                 .98
 SLOPE M(MPa)                      80
 INTERCEPT B (KN/M)                80

                VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD          YES
 LIGAMENT>25JIC/EFFECTIVE YIELD    YES
 DJ/DA<EFFECTIVE YIELD             YES

                QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                            NO
 CRACK SIZE DA<0.15*DELTA A                          YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     437.22
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   313.12
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    1.998
 25*JQ/EF.Y.(CM)                                     .504

                CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        10
 LAST DATA POINT USED       25
 CONSTANT(C1)               162.76
 EXPONENT(C2)               .4575
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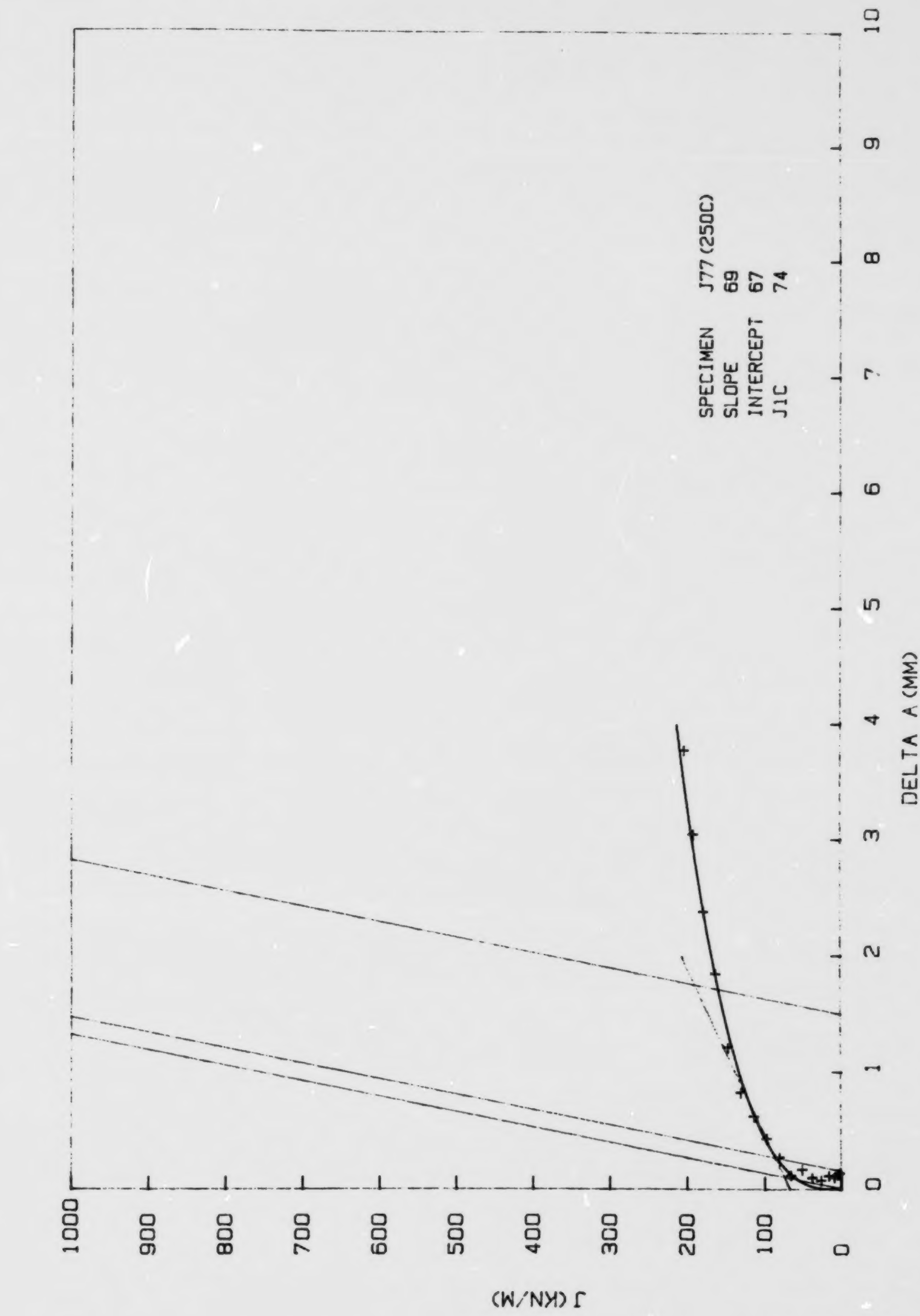
```
          J76(RT)

 K          J-ELASTIC      J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)  CR. LN
 (MPaRTM)   (KN/M)          (KN/M)        (KN/M)     (KN/M)          (KN/M)        (CM)

 24.13      2.75            .03           2.78        2.78         2.97       3.089  1
 33.55      5.33            .09           5.42        5.42         5.78       3.088  2
 42.19      8.42            1.01          9.44        9.44         10.01      3.089  3
 50.58      12.1            3.19          15.29       15.29        16.13      3.088  4
 58.07      15.95           7.59          23.54       23.59        24.59      3.108  5
 62.38      18.41           18.41         36.82       36.79        38.1       3.095  6
 63.84      19.28           35.46         54.75       54.71        56.09      3.094  7
 65.81      20.49           52.63         73.12       73.43        74.45      3.109  8
 66.98      21.23           71.74         92.97       93.37        94.33      3.111  9
 68.9       22.46           89.86         112.32      113.78       113.62     3.134  10
 69.94      23.14           109.24        132.38      134.94       133.6      3.152  11
 71.35      24.08           128.53        152.61      156.72       153.75     3.174  12
 72.42      24.81           147.99        172.8       178.72       173.84     3.195  13
 73         25.21           167.42        192.64      201.64       193.49     3.225  14
 72.96      25.19           187.3         212.49      225.29       213.1      3.258  15
 73.79      25.76           204.01        229.77      248.65       230.13     3.305  16
 74.02      25.92           222.89        248.82      272.22       248.96     3.336  17
 73.6       25.63           240           265.63      295.56       265.5      3.377  18
 74.63      26.35           253.19        279.54      317.62       279.23     3.423  19
 73.85      25.8            269.76        295.56      340.68       294.99     3.46   20
 73.64      25.66           284.51        310.17      362.75       309.39     3.496  21
 73.87      25.82           295.68        321.5       384.25       320.55     3.542  22
 73.71      25.7            309.72        335.43      405.55       334.3      3.573  23
 73.35      25.46           322.56        348.02      426.39       346.72     3.606  24
 74.69      26.39           329.79        356.18      446.21       354.85     3.65   25

 H(M)             D(M)           POISSON'S RATIO
 .01901           2.54E-03       .3
```

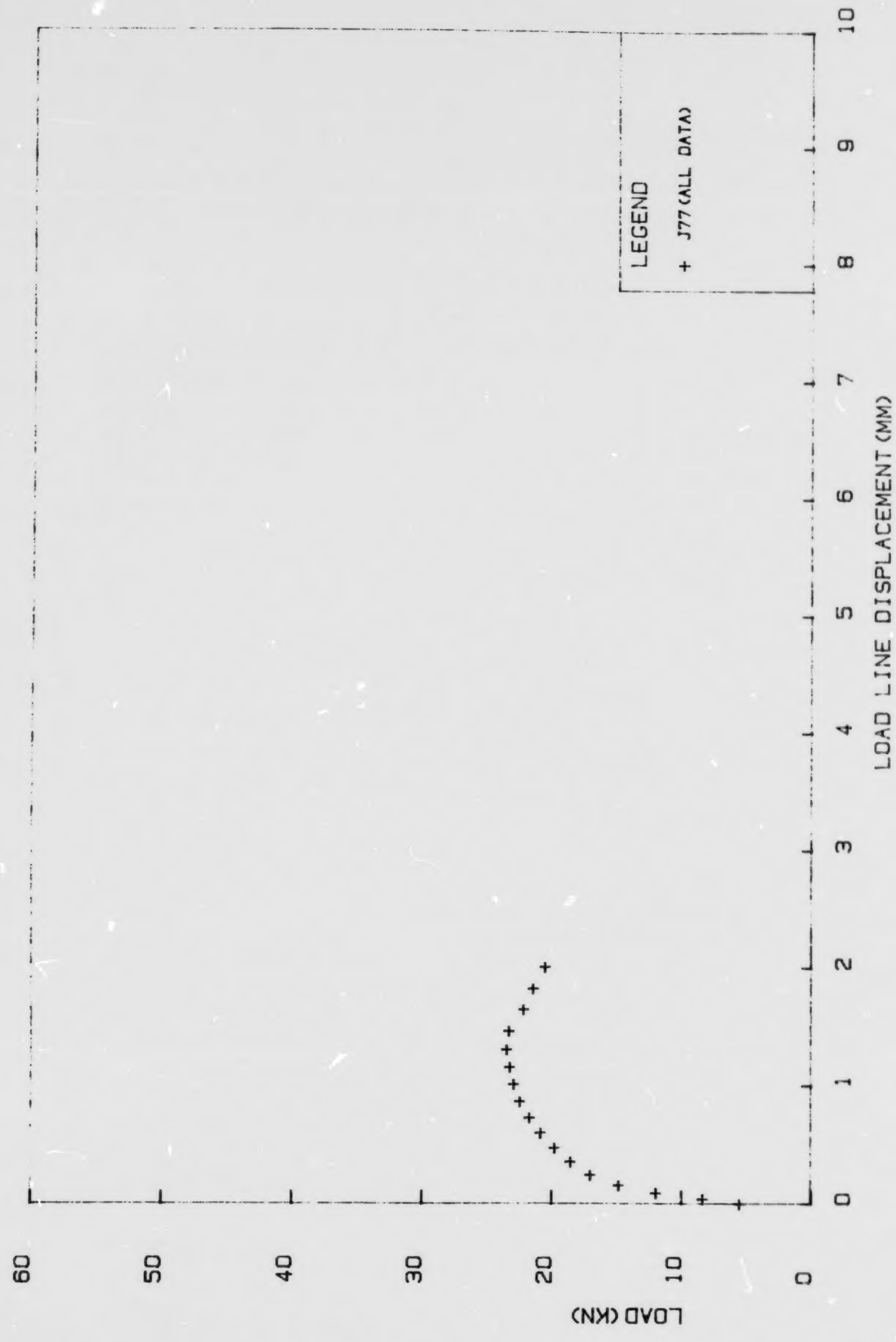
J76

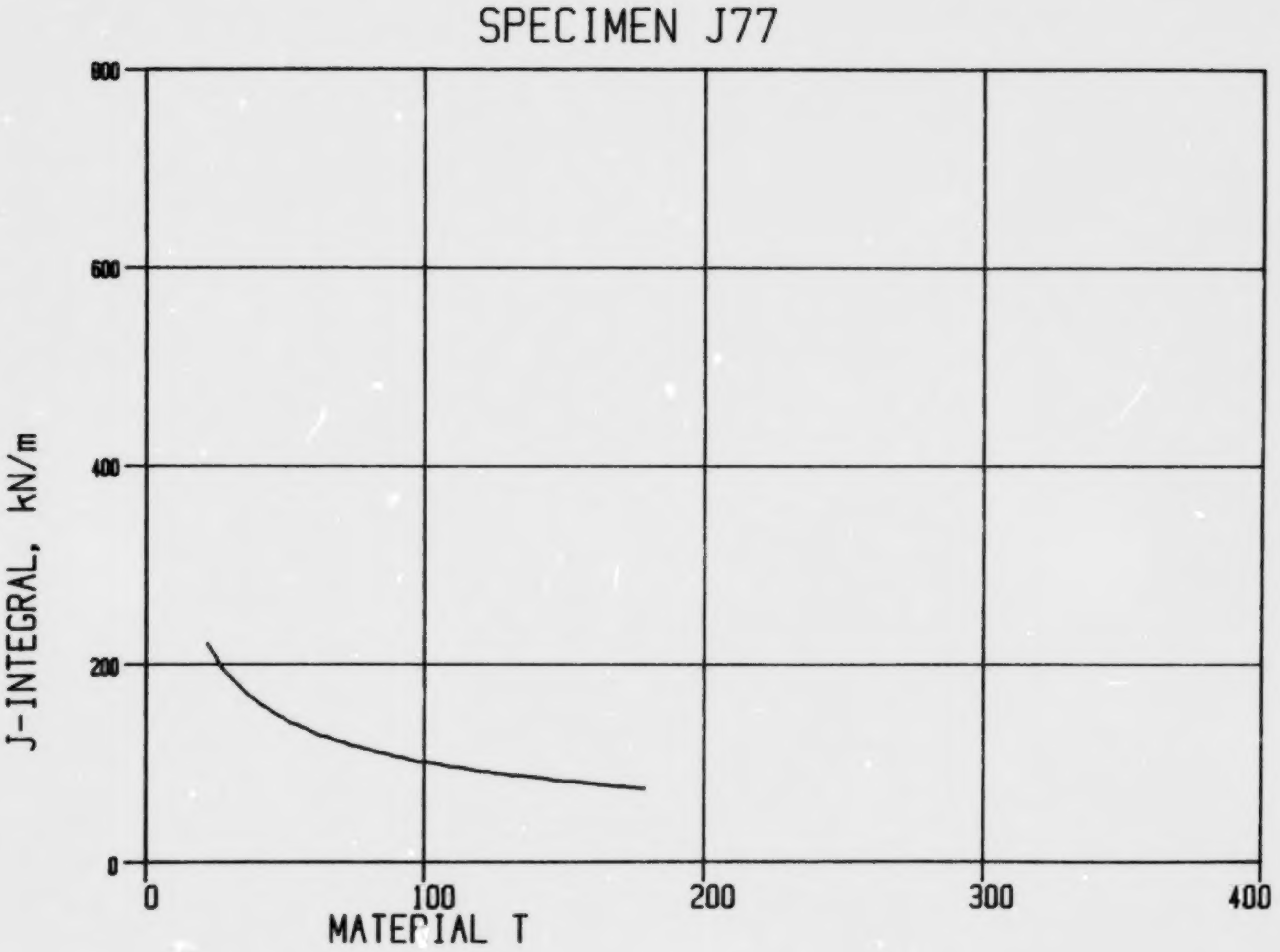
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.78	3.089	3.089	.022	.9996	1
5.42	3.088	3.088	.011	1	2
9.44	3.089	3.089	.023	1	3
15.29	3.087	3.088	9E-03	.9999	4
23.54	3.106	3.108	.21	.9998	5
36.82	3.093	3.095	.079	.9999	6
54.75	3.091	3.094	.066	.9996	7
73.12	3.105	3.109	.218	1	8
92.97	3.107	3.111	.244	.9999	9
112.32	3.128	3.134	.468	.9999	10
132.38	3.146	3.152	.653	.9996	11
152.61	3.166	3.174	.866	.9998	12
172.8	3.187	3.195	1.076	.9998	13
192.64	3.216	3.225	1.383	.9996	14
212.49	3.249	3.258	1.713	.9999	15
229.77	3.295	3.305	2.179	.9999	16
248.82	3.325	3.336	2.491	.9996	17
265.63	3.365	3.377	2.897	.9997	18
279.54	3.411	3.423	3.359	.9994	19
295.56	3.447	3.46	3.729	.9997	20
310.17	3.483	3.496	4.09	.9996	21
321.5	3.528	3.542	4.549	.9996	22
335.43	3.559	3.573	4.862	.9995	23
348.02	3.592	3.606	5.19	.9996	24
356.18	3.635	3.65	5.628	.9996	25

```
           LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J76
 1          5.859          0
 2          8.728          .042
 3          12.146         .09
 4          15.259         .146
 5          18.311         .212
 6          20.691         .294
 7          22.461         .404
 8          23.01          .547
 9          23.438         .696
 10         23.804         .848
 11         24.048         1.006
 12         24.048         1.166
 13         24.109         1.329
 14         24.048         1.493
 15         23.621         1.665
 16         22.949         1.844
 17         22.278         2.028
 18         21.729         2.209
 19         20.813         2.395
 20         20.203         2.576
 21         19.287         2.764
 22         18.555         2.948
 23         17.761         3.135
 24         17.151         3.318
 25         16.479         3.501
 26         15.991         3.683
```

	J(KN/M)	T	W	J76
1	83.04	747.2	175.78	
2	102.64	87.3	16.43	
3	122.35	109.55	17.13	
4	142.5	96.19	12.77	
5	162.71	97.07	11.16	
6	182.72	65.32	6.58	
7	202.56	60.71	5.42	
8	221.13	37.51	2.99	
9	239.29	61.63	4.46	
10	257.22	41.84	2.75	
11	272.58	30.42	1.84	
12	287.55	43.76	2.45	
13	302.87	40.81	2.12	
14	315.84	24.94	1.21	
15	328.46	44.96	2.05	
16	341.72	38.77	1.66	
17	352.1	18.82	.76	


SPECIMEN J77 (250C)
SLOPE 69
INTERCEPT 67
J1C 74
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J77 (ALL DATA)


SPECIMEN J77
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

SPECIMEN NUMBER                                       J77
MATERIAL TYPE                                         A105 FORGING
MATERIAL CONDITION                                    PARENT
TEST TEMPERATURE(DEG C)                               250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             228.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           526.4
CRACK PLANE ORIENTATION (PER ASTM E399)               C-L
SPECIMEN THICKNESS B(CM)                              2.541
PERCENT SIDE GROOVE                                   20.031
SPECIMEN WIDTH W(CM)                                  5.081
YOUNGS MODULUS AT TEST TEMP(Pa)                       1.82776E+11
EFFECTIVE MODULUS(Pa)                                 2.01587399E+11

               FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              22.38
INITIAL CRACK LENGTH-COMPLIANCE(CM)                   2.989

               CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                        3.079
INITIAL A/W                                           .588
AVERAGE CRACK EXTENSION 9PT(CM)                       .419
DELTA A(CM) COMPLIANCE                                .377
MAX DEVIATION OF SINGLE MEASUREMENT %                 1.06

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                         9
LAST POINT                          13
JIC(KN/M)                           74
CORRELATION COEFF                   .97
SLOPE M(MPa)                        69
INTERCEPT B (KN/M)                  67

               VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD            YES
LIGAMENT>25JIC/EFFECTIVE YIELD      YES
DJ/DA<EFFECTIVE YIELD               YES

               QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                              YES
CRACK SIZE DA<0.15*DELTA A                            YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       383.39
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     323.54
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.092
25*JQ/EF.Y.(CM)                                       .49

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED            9
LAST DATA POINT USED           17
CONSTANT(C1)                   132.97
EXPONENT(C2)                   .3435
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          J77(250C)

K          J-ELASTIC      J-PLASTIC     JEL+JPL       J(M)         J(TO.AREA)   CR.  LN
(MPaRTM)    (KN/M)         (KN/M)        (KN/M)      (KN/M)          (KN/M)          (CM)

21.51      2.3             .04           2.35         2.35          2.45      3.002  1
30.76      4.71            .16           4.87         4.87          5.12      3.001  2
38.06      7.21           2.15           9.36         9.36          9.76      2.999  3
43.74      9.53           7.01          16.54        16.54         17.07      3      4
47.51      11.24          15.48         26.72        26.71         27.38      2.996  5
50.73      12.81          25.62         38.44        38.44         39.17      2.998  6
53.84      14.43          37.07         51.5         51.62         52.3       3.005  7
55.83      15.52          50.71         66.23        66.23         67.12      3      8
58.38      16.97          64.26         81.23        81.72         82.14      3.016  9
60.39      18.16          79.45         97.61        98.76         98.5       3.032  10
62.09      19.2           94.85         114.04       116.16        114.91     3.051  11
63.76      20.24          110.86        131.1        134.48        131.92     3.071  12
65.23      21.18          126.18        147.36       153.51        148.04     3.11   13
65.24      21.19          142.33        163.52       174.89        163.85     3.173  14
66         21.69          157.19        178.88       195.42        178.96     3.227  15
66.97      22.33          169.72        192.05       215.83        191.87     3.294  16
67.47      22.66          181.62        204.28       236.77        203.81     3.366  17

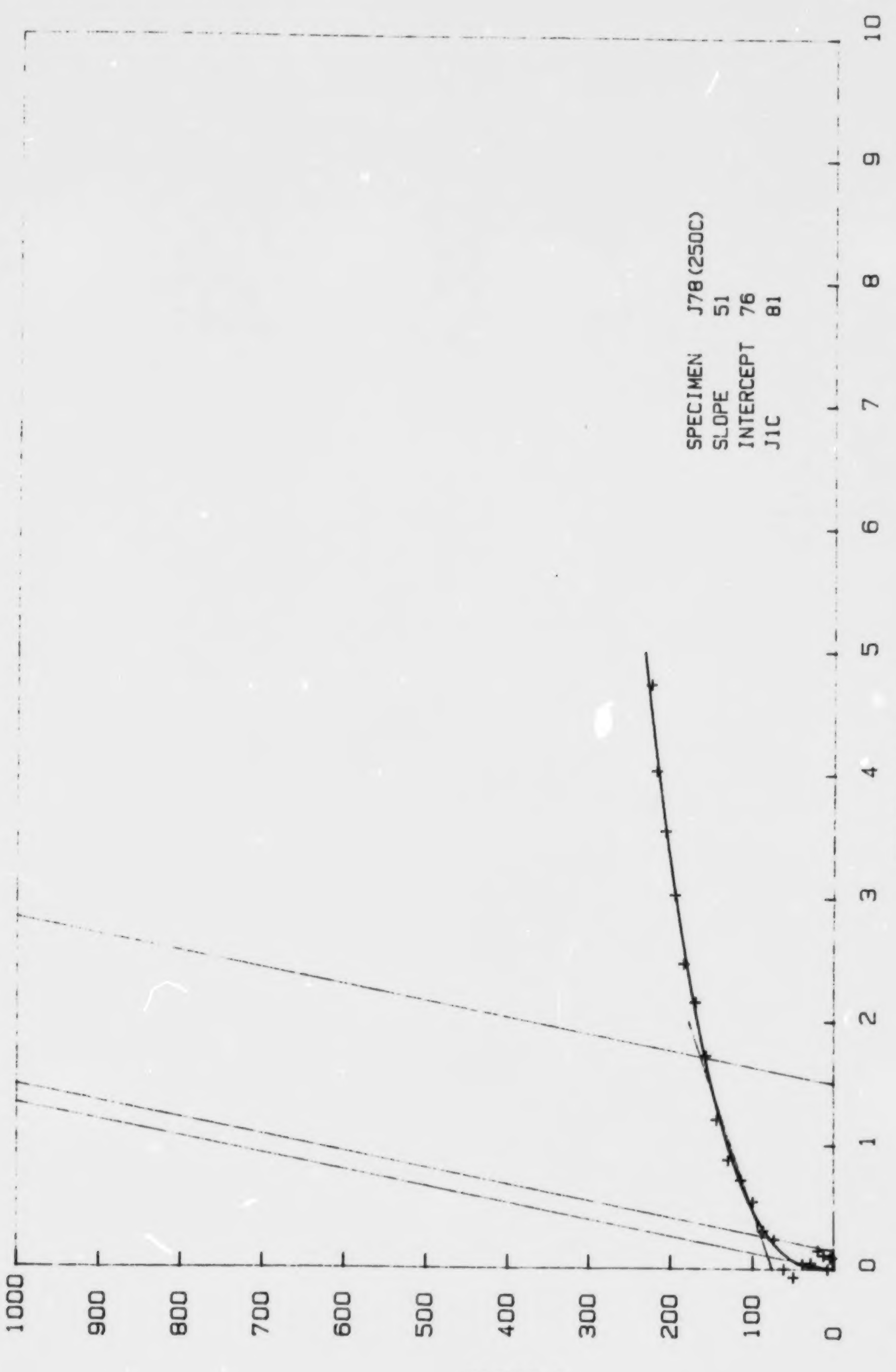
H(M)             D(M)            POISSON'S RATIO
.01906           2.54E-03        .3
```

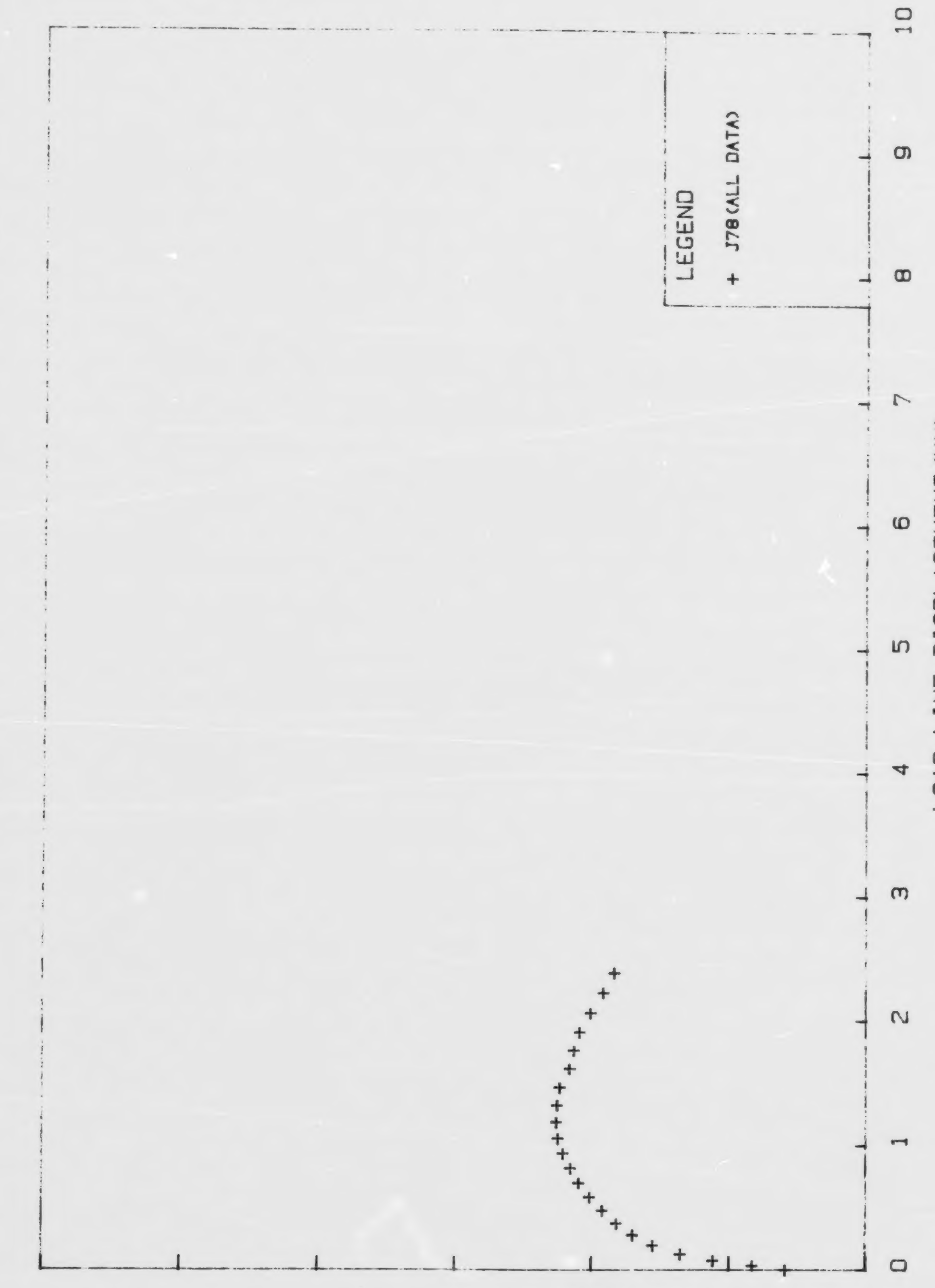
J77

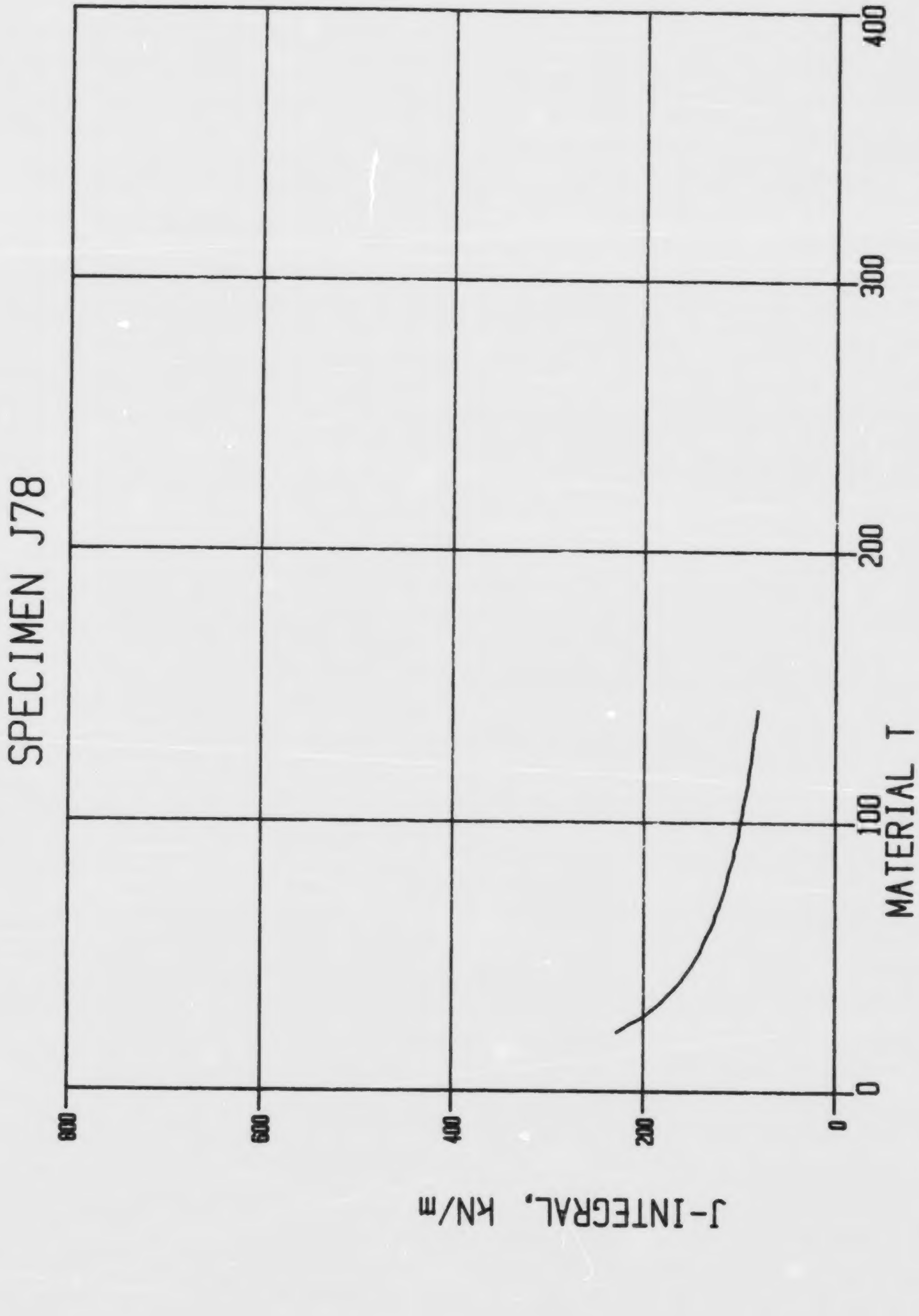
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.35	3.002	3.002	.131	.9998	1
4.87	3.001	3.001	.121	.9999	2
9.36	2.998	2.999	.095	.9999	3
16.54	2.998	3	.108	.9999	4
26.72	2.994	2.996	.067	.9999	5
38.44	2.995	2.998	.092	1	6
51.5	3.002	3.005	.164	.9999	7
66.23	2.996	3	.113	1	8
81.23	3.01	3.016	.266	.9999	9
97.61	3.026	3.032	.427	.9999	10
114.04	3.044	3.051	.617	.9998	11
131.1	3.064	3.071	.825	.9998	12
147.36	3.102	3.11	1.211	.9999	13
163.52	3.164	3.173	1.842	.9999	14
178.88	3.217	3.227	2.38	.9999	15
192.05	3.284	3.294	3.049	.9999	16
204.28	3.356	3.366	3.772	.9997	17

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J77
1	5.493	0	
2	8.362	.04	
3	11.963	.09	
4	14.832	.156	
5	17.029	.244	
6	18.555	.354	
7	19.775	.472	
8	20.874	.598	
9	21.729	.729	
10	22.461	.865	
11	22.949	1.011	
12	23.254	1.156	
13	23.499	1.306	
14	23.315	1.464	
15	22.156	1.647	
16	21.423	1.824	
17	20.508	2.006	
18	19.348	2.197	

	J(KN/M)	T	W	J77
1	73.73	126.36	27.58	
2	89.42	129.95	23.2	
3	105.83	111.03	16.59	
4	122.57	105.64	13.49	
5	139.23	54.01	5.96	
6	155.44	32.89	3.14	
7	171.2	36.6	3.09	
8	185.46	25.29	1.9	
9	198.17	21.71	1.46	


SPECIMEN J78(250C)
SLOPE 51
INTERCEPT 76
J1C 81
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J78 (ALL DATA)


SPECIMEN J78
J-INTEGRAL, kN/m
0
200
400
600
800
0
100
200
300
400
MATERIAL T

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     DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

 SPECIMEN NUMBER                                   J78
 MATERIAL TYPE                                     A105 FORGING
 MATERIAL CONDITION                                PARENT
 TEST TEMPERATURE(DEG C)                           250
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         228.3
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       526.4
 CRACK PLANE ORIENTATION (PER ASTM E399)           C-L
 SPECIMEN THICKNESS B(CM)                          2.54
 PERCENT SIDE GROOVE                               19.921
 SPECIMEN WIDTH W(CM)                              5.093
 YOUNGS MODULUS AT TEST TEMP(Pa)                   1.82776E+11
 EFFECTIVE MODULUS(Pa)                             1.94522362E+11

                  FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN             10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          22.83
 INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.024

                  CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                    3.079
 INITIAL A/W                                       .594
 AVERAGE CRACK EXTENSION 9PT(CM)                   .506
 DELTA A(CM) COMPLIANCE                            .474
 MAX DEVIATION OF SINGLE MEASUREMENT %             1.56

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                    11
 LAST POINT                     16
 JIC(KN/M)                      81
 CORRELATION COEFF              .94
 SLOPE M(MPa)                   51
 INTERCEPT B (KN/M)             76

                  VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD       YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD          YES

                  QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                          YES
 CRACK SIZE DA<0.15*DELTA A                        YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   383.76
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 300.96
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.069
 25*JQ/EF.Y.(CM)                                   .537

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        11
 LAST DATA POINT USED       22
 CONSTANT(C1)               130.8
 EXPONENT(C2)               .3595
```

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          J78(250C)

 K         J-ELASTIC     J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)         (KN/M)        (KN/M)     (KN/M)         (KN/M)        (CM)

 21.72      2.35           .04           2.39        2.39          2.51    3.033  1
 29.23      4.25           .09           4.34        4.34          4.58    3.034  2
 35.2       6.17          1.52           7.69        7.69          8.05    3.024  3
 40.78      8.28          4.44          12.72       12.73         13.19    3.035  4
 44.75      9.97          9.85          19.82       19.84         20.39    3.039  5
 47.44     11.2          17.35          28.55       28.51         29.22    3.029  6
 50.11     12.5          26.21          38.72       38.67         39.46    3.028  7
 52.07     13.5          36.6           50.1        49.87         50.94    3.018  8
 54.4      14.74         47.39          62.13       62.06         63.02    3.024  9
 57.02     16.19         57.88          74.07       74.71         74.96    3.048  10
 58.78     17.2          70.03          87.23       88.13         88.16    3.055  11
 60.84     18.43         81.49          99.92      101.86        100.83    3.078  12
 62.01     19.15         95.18         114.33      117.19        115.21    3.096  13
 62.65     19.54        110.31         129.86      133.73        130.69    3.112  14
 63.78     20.25        123.78         144.03      150.25        144.77    3.145  15
 64.36     20.62        136.63         157.25      167.7         157.78    3.196  16
 65.82     21.57        148.36         169.93      184.4         170.34    3.24   17
 66.26     21.86        162.24         184.1       201.76        184.39    3.271  18
 66.96     22.32        172.78         195.1       219.08        195.22    3.327  19
 67.01     22.35        184.34         206.69      237.08        206.6     3.379  20
 67.24     22.51        195.06         217.57      254.52        217.3     3.427  21
 67.27     22.53        201.85         224.38      271.65        223.96    3.498  22

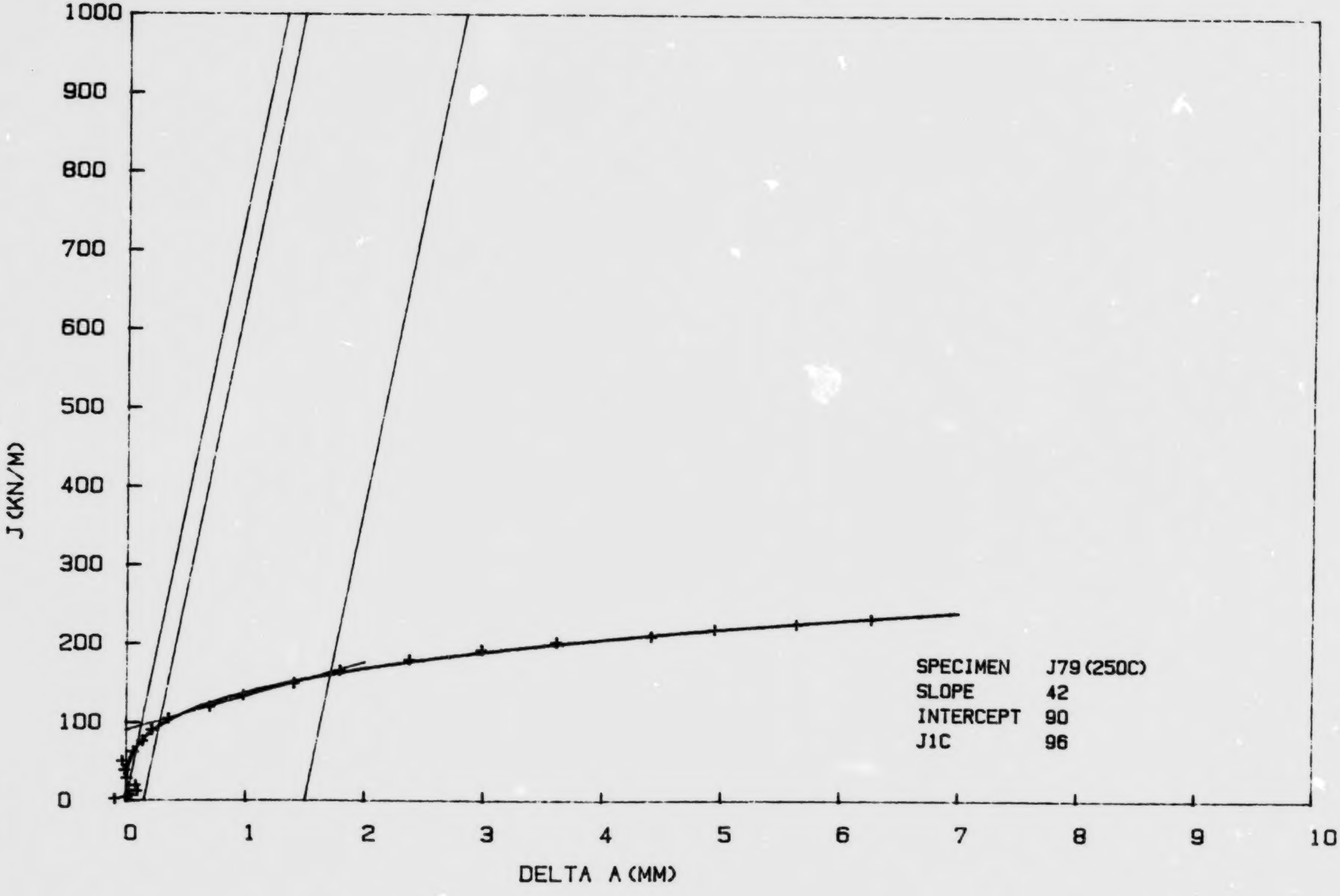
 H(M)            D(M)            POISSON'S RATIO
 .01905          2.54E-03        .3
```

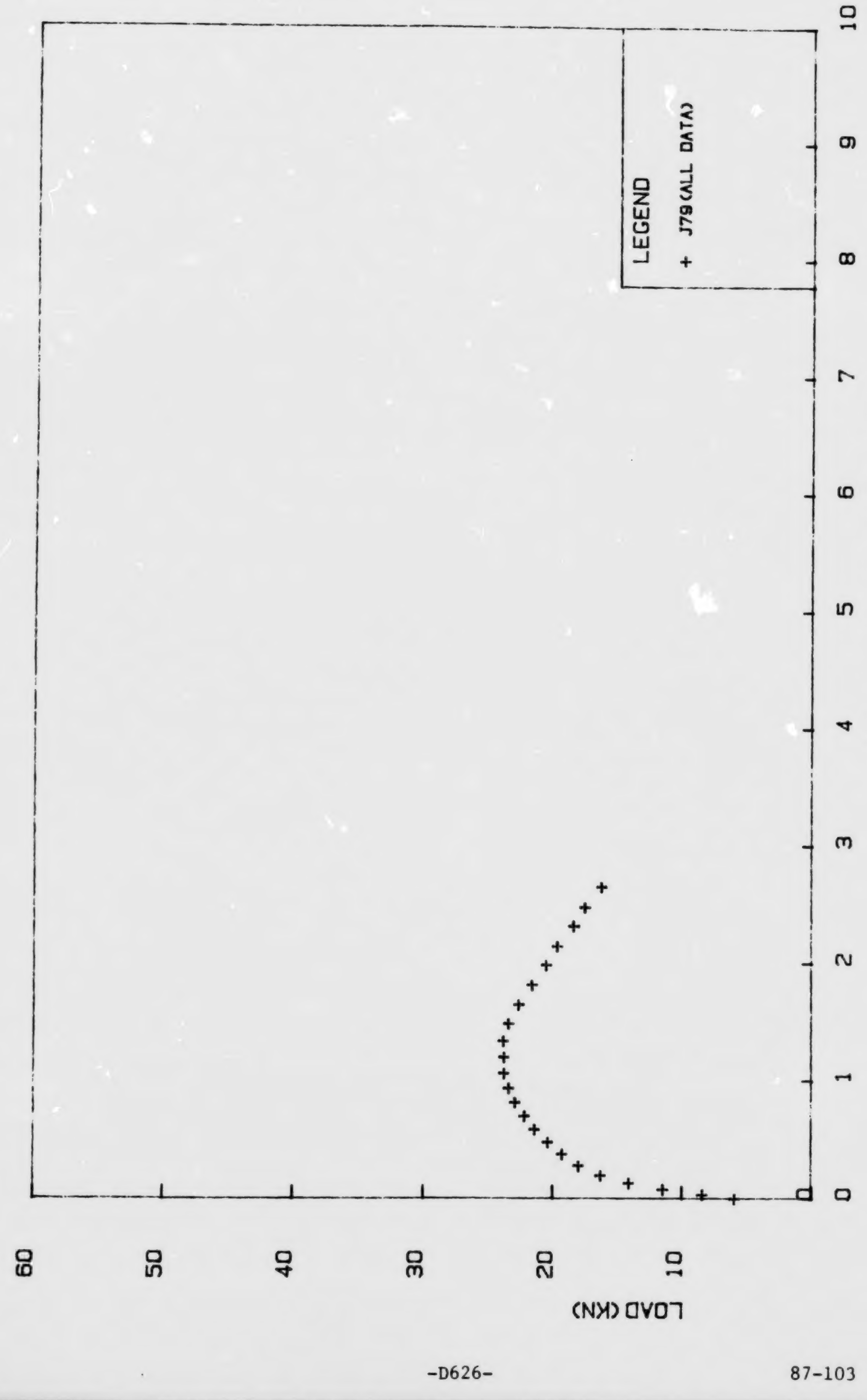
J78

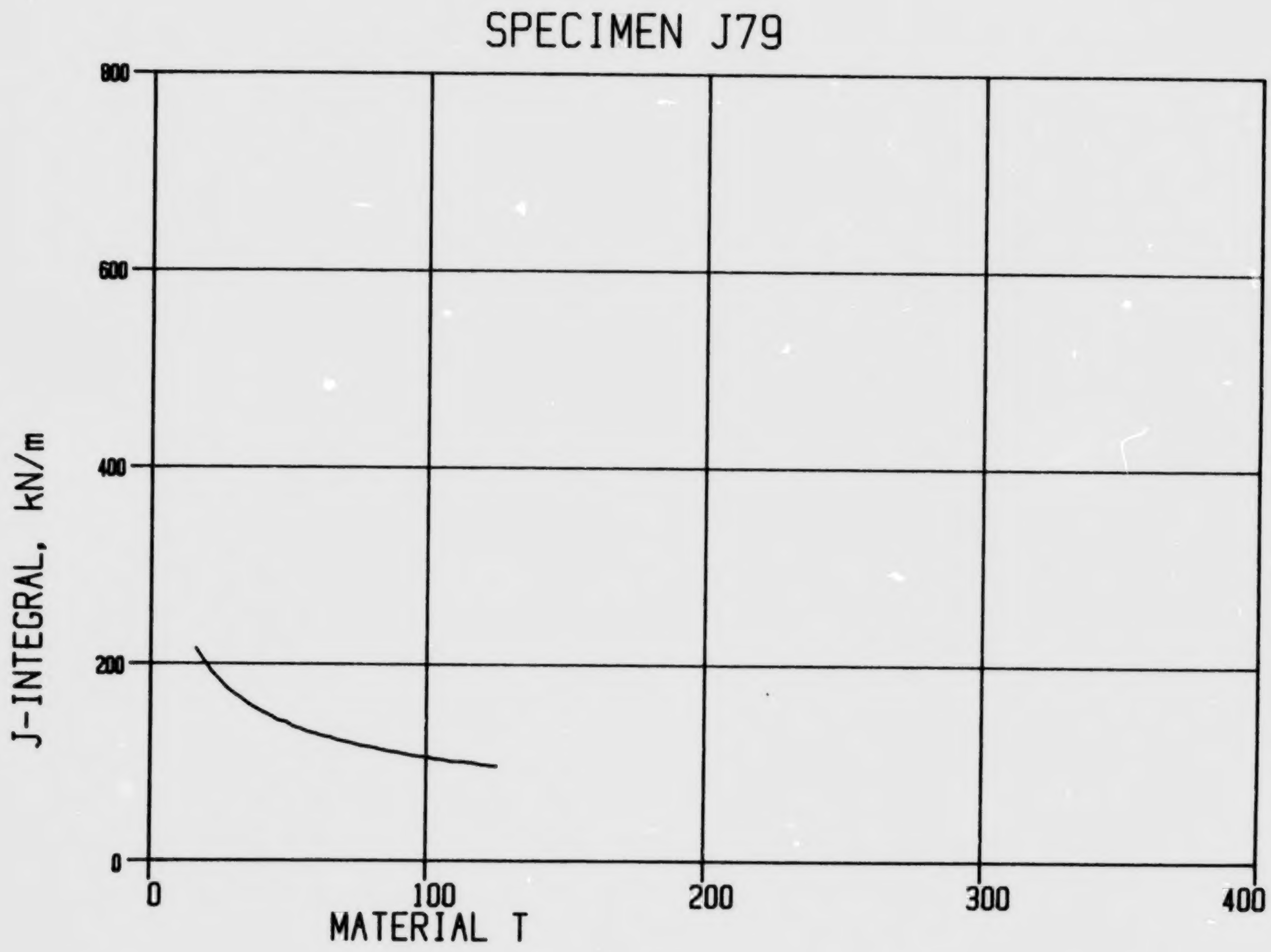
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.39	3.033	3.033	.092	.9997	1
4.34	3.033	3.034	.096	.9999	2
7.69	3.023	3.024	0	.9999	3
12.72	3.034	3.035	.113	.9999	4
19.82	3.038	3.039	.151	1	5
28.55	3.027	3.029	.051	.9999	6
38.72	3.026	3.028	.043	.9998	7
50.1	3.014	3.018	-.065	.9999	8
62.13	3.02	3.024	4E-03	.9999	9
74.07	3.043	3.048	.242	1	10
87.23	3.05	3.055	.31	1	11
99.92	3.072	3.078	.543	.9998	12
114.33	3.089	3.096	.718	.9999	13
129.86	3.105	3.112	.882	.9999	14
144.03	3.136	3.145	1.206	.9999	15
157.25	3.188	3.196	1.723	.9999	16
169.93	3.231	3.24	2.158	.9999	17
184.1	3.261	3.271	2.47	.9999	18
195.1	3.317	3.327	3.028	.9999	19
206.69	3.368	3.379	3.546	.9998	20
217.57	3.416	3.427	4.032	.9997	21
224.38	3.487	3.498	4.739	.9996	22

	J(KN/M)	T	W	J78
1	80.65	248.97	49.01	
2	93.57	69.7	11.69	
3	107.12	106.2	15.43	
4	122.09	121.39	15.34	
5	136.95	56.07	6.22	
6	150.64	32.82	3.22	
7	163.59	37.42	3.3	
8	177.02	58.25	4.67	
9	189.6	25.34	1.84	
10	200.9	28.69	1.91	
11	212.13	28.73	1.76	
12	220.98	12.37	.7	

```
          LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      J78
 1         5.859          0
 2         8.301           .035
 3         11.169          .076
 4         13.55           .128
 5         15.564          .197
 6         17.029          .281
 7         18.188          .374
 8         19.226          .477
 9         20.142          .585
 10        20.935          .699
 11        21.545          .817
 12        22.095          .934
 13        22.461         1.053
 14        22.583         1.183
 15        22.522         1.321
 16        22.339         1.461
 17        21.606         1.614
 18        21.301         1.759
 19        20.874         1.907
 20        20.081         2.062
 21        19.165         2.224
 22        18.372         2.384
 23        17.151         2.552
```


SPECIMEN J79 (250C)
SLOPE 42
INTERCEPT 90
J1C 96
J (KN/M)
1000
900
800
700
600
500
400
300
200
100
0
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J79 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J79
J-INTEGRAL, kN/m
800
600
400
200
0
0
100
200
300
400
MATERIAL T

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J79
MATERIAL TYPE	A105 FORGING
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	228.3
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	526.4
CRACK PLANE ORIENTATION (PER ASTM E399)	C-L
SPECIMEN THICKNESS B(CM)	2.541
PERCENT SIDE GROOVE	19.952
SPECIMEN WIDTH W(CM)	5.079
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.07259577E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	22.03
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.966

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.059
INITIAL A/W	.584
AVERAGE CRACK EXTENSION 9PT(CM)	.697
DELTA A(CM) COMPLIANCE	.626
MAX DEVIATION OF SINGLE MEASUREMENT %	1.03

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	12
LAST POINT	15
JIC(KN/M)	96
CORRELATION COEFF	.99
SLOPE M(MPa)	42
INTERCEPT B (KN/M)	90

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	383.76
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	280.49
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.113
25*JQ/EF.Y.(CM)	.636

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	12
LAST DATA POINT USED	23
CONSTANT(C1)	137.96
EXPONENT(C2)	.2881

J79(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
20.96	2.19	.05	2.24	2.24	2.39	2.957	1
28.76	4.12	.24	4.36	4.36	4.61	2.966	2
35.42	6.25	1.44	7.69	7.69	8.05	2.969	3
41.12	8.42	4.28	12.7	12.7	13.18	2.975	4
45.39	10.26	9.61	19.87	19.87	20.46	2.974	5
48.36	11.64	17.58	29.22	29.18	29.91	2.967	6
51.04	12.97	26.59	39.56	39.49	40.33	2.965	7
53.56	14.28	36.83	51.11	51.02	51.97	2.963	8
55.92	15.57	47.9	63.47	63.58	64.36	2.972	9
58.11	16.81	59.91	76.72	77.08	77.66	2.98	10
59.68	17.73	73.07	90.8	91.44	91.77	2.987	11
61.25	18.68	86.66	105.34	106.61	106.3	3.001	12
62.88	19.69	100.24	119.92	123.09	120.8	3.036	13
64.42	20.66	114.18	134.85	139.81	135.66	3.064	14
65.42	21.31	128.42	149.73	157.82	150.39	3.106	15
65.21	21.17	144.79	165.97	177.33	166.42	3.145	16
65.31	21.24	158.38	179.62	196.62	179.82	3.204	17
65.3	21.23	170.86	192.09	215.66	192.04	3.264	18
66.19	21.81	180.31	202.12	233.22	201.9	3.327	19
66.64	22.11	187.4	209.52	251	209.14	3.407	20
66.91	22.29	196.63	218.93	267.89	218.39	3.461	21
66.46	21.99	203.83	225.83	285.15	225.12	3.529	22
65.96	21.66	211.05	232.72	302.27	231.85	3.592	23

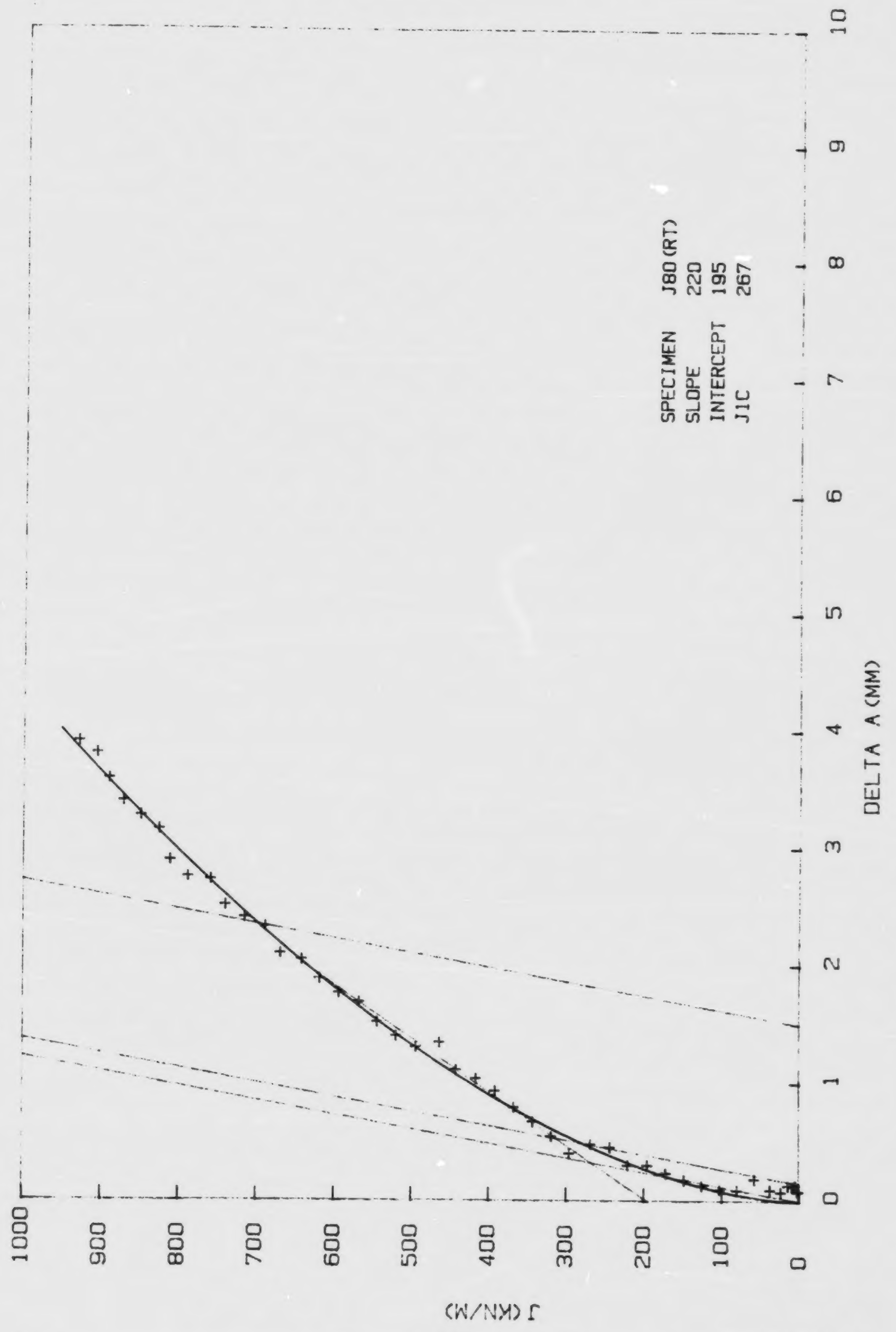
H(M)	D(M)	POISSON'S RATIO
.01907	2.54E-03	.3

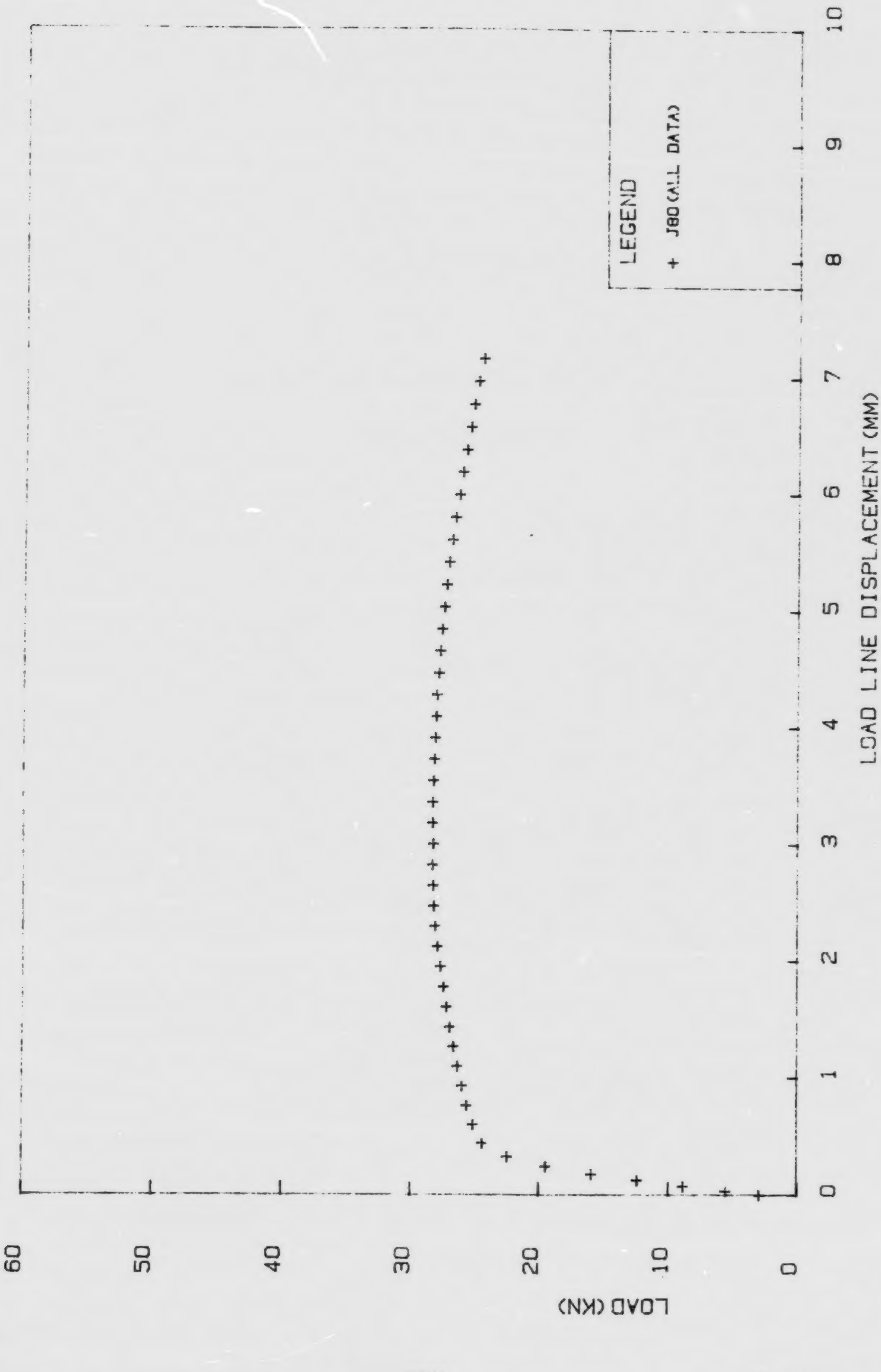
J79

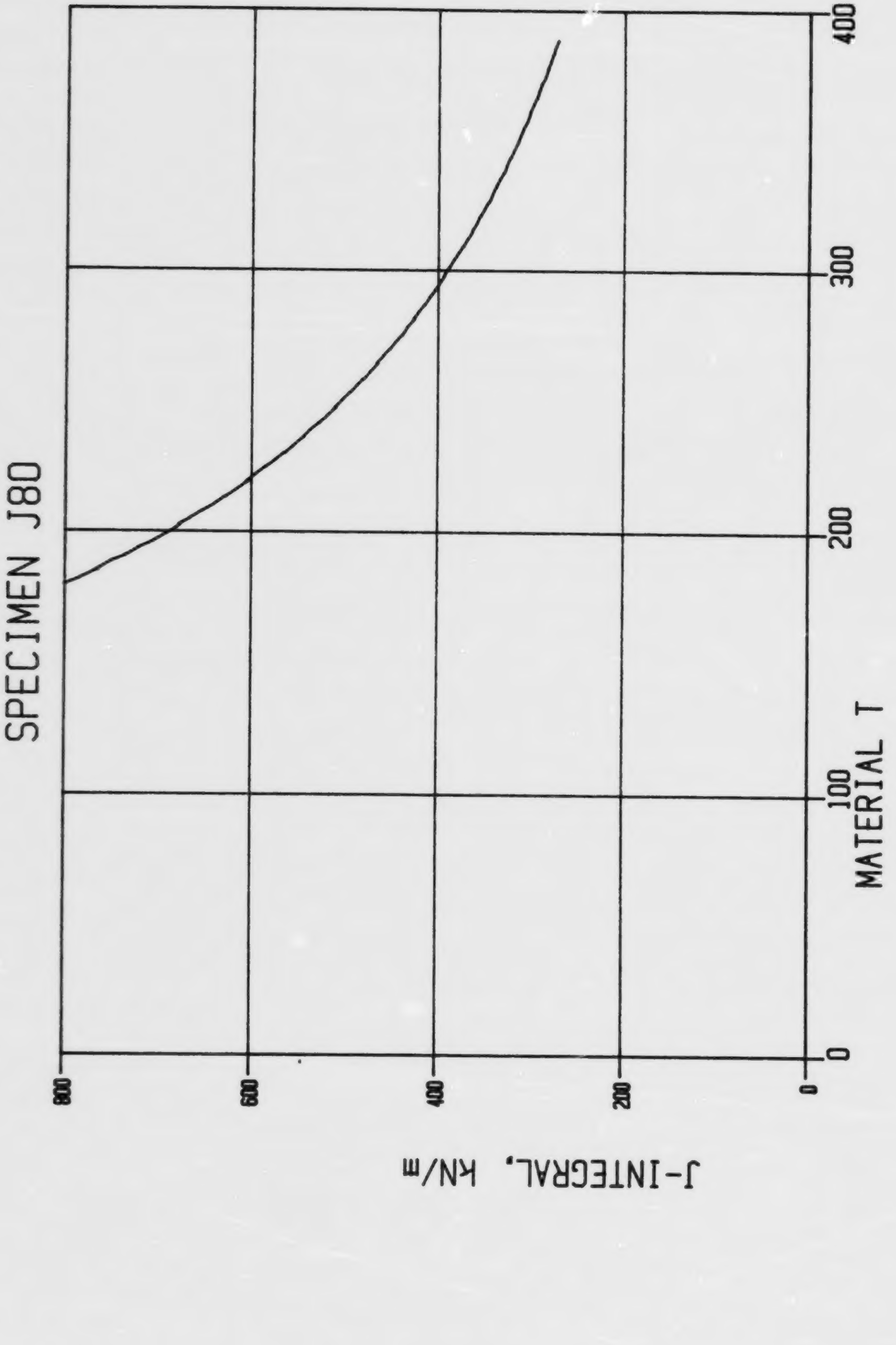
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.24	2.956	2.957	-.094	.9999	1
4.36	2.966	2.966	3E-03	1	2
7.69	2.969	2.969	.034	.9999	3
12.7	2.974	2.975	.094	1	4
19.87	2.972	2.974	.081	1	5
29.22	2.964	2.967	6E-03	.9999	6
39.56	2.962	2.965	-.013	.9999	7
51.11	2.959	2.963	-.032	.9999	8
63.47	2.968	2.972	.059	.9994	9
76.72	2.975	2.98	.139	.9999	10
90.8	2.982	2.987	.215	.9999	11
105.34	2.995	3.001	.353	.9999	12
119.92	3.029	3.036	.7	.9998	13
134.85	3.056	3.064	.98	.9997	14
149.73	3.098	3.106	1.404	.9998	15
165.97	3.136	3.145	1.792	.9995	16
179.62	3.194	3.204	2.376	.9997	17
192.09	3.254	3.264	2.984	.9999	18
202.12	3.317	3.327	3.612	.9991	19
209.52	3.396	3.407	4.412	.9998	20
218.93	3.449	3.461	4.945	.9991	21
225.83	3.518	3.529	5.632	.9993	22
232.72	3.581	3.592	6.263	.9997	23

```
             LOAD(KN)       LOAD LINE DISPLACEMENT(MM)       J79
  1           5.92           0
  2           8.423           .034
  3          11.475           .078
  4          14.099           .131
  5          16.296           .177
  6          18.005           .278
  7          19.287           .375
  8          20.386           .476
  9          21.423           .583
  10         22.217           .697
  11         22.949           .814
  12         23.438           .935
  13         23.804          1.061
  14         23.804          1.199
  15         23.865          1.335
  16         23.438          1.484
  17         22.644          1.646
  18         21.606          1.813
  19         20.508          1.982
  20         19.653          2.144
  21         18.372          2.316
  22         17.517          2.476
  23         16.235          2.649
  24         15.076          2.826
```

	J(KN/M)	T	W	J79
1	98.07	135.22	22.32	
2	112.63	53.97	7.63	
3	127.38	68.47	8.44	
4	142.29	45.03	4.86	
5	157.85	53.71	5.13	
6	172.79	30.01	2.54	
7	185.86	26.35	2	
8	197.1	20.46	1.42	
9	205.82	11.88	.75	
10	214.22	22.65	1.33	
11	222.38	12.9	.7	
12	229.27	14.01	.71	


SPECIMEN J80(RT)
SLOPE 220
INTERCEPT 195
J1C 267
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J80 (ALL DATA)


SPECIMEN J80
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
     DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

SPECIMEN NUMBER                                     J80
MATERIAL TYPE                                       A106B
MATERIAL CONDITION                                  WELD(PN232)
TEST TEMPERATURE(DEG C)                             20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)           309
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)         512
CRACK PLANE ORIENTATION (PER ASTM E399)             L-C
SPECIMEN THICKNESS B(CM)                            2.539
PERCENT SIDE GROOVE                                 20.244
SPECIMEN WIDTH W(CM)                                5.082
YOUNGS MODULUS AT TEST TEMP(Pa)                     1.92346E+11
EFFECTIVE MODULUS(Pa)                               2.18826168E+11

                  FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN               10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM            22.52
INITIAL CRACK LENGTH-COMPLIANCE(CM)                 2.997

                  CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                      3.109
INITIAL A/W                                         .59
AVERAGE CRACK EXTENSION 9PT(CM)                     .414
DELTA A(CM) COMPLIANCE                              .39
MAX DEVIATION OF SINGLE MEASUREMENT %               1.56

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                        19
LAST POINT                         34
JIC(KN/M)                          267
CORRELATION COEFF                  .99
SLOPE M(MPa)                       220
INTERCEPT B (KN/M)                 195

                  VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD           YES
LIGAMENT>25JIC/EFFECTIVE YIELD     YES
DJ/DA<EFFECTIVE YIELD              YES

                  QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                            NO
CRACK SIZE DA<0.15*DELTA A                          YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                     415.63
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                   347.86
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                    2.085
25*JQ/EF.Y.(CM)                                     1.626

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED          19
LAST DATA POINT USED         45
CONSTANT(C1)                 423.8
EXPONENT(C2)                 .5837
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          J80(RT)

K          J-ELASTIC    J-PLASTIC    JEL+JPL    J(M)       J(TO.AREA)  CR. LN
(MPaRTM)   (KN/M)       (KN/M)       (KN/M)     (KN/M)       (KN/M)        (CM)

14.35      .97          .01          .99        .99        1.04       3.006  1
22.86      2.47         0            2.47       2.47       2.61       3.005  2
32.14      4.89         .29          5.17       5.17       5.46       3.011  3
41.28      8.06         .94          9          9          9.48       3.009  4
50.49      12.06        2.61         14.67      14.67      15.39      3.01   5
58.01      15.92        8.04         23.95      23.95      24.93      3.005  6
63.14      18.86        19.03        37.89      37.89      39.03      3.007  7
65.49      20.29        37.94        58.23      58.34      59.4       3.016  8
66.27      20.78        59.81        80.59      80.47      81.86      3.006  9
67.25      21.4         81.69        103.08     102.98     104.39     3.007  10
68.36      22.11        103.93       126.04     126.1      127.36     3.01   11
69.41      22.79        125.99       148.79     149.17     150.12     3.015  12
70.51      23.52        148.5        172.03     172.88     173.36     3.021  13
71.51      24.19        171.55       195.75     197.22     197.07     3.027  14
72.15      24.63        196.29       220.91     222.38     222.27     3.027  15
73.65      25.66        218.31       243.97     247.35     245.28     3.043  16
74.44      26.22        242.75       268.96     272.69     270.29     3.045  17
74.47      26.23        269.86       296.1      298.57     297.49     3.037  18
75.64      27.07        292.14       319.2      324.21     320.54     3.052  19
76.52      27.71        315.53       343.24     350.54     344.52     3.064  20
77.44      28.37        339.23       367.6      377.43     368.84     3.076  21
78.12      28.87        363.06       391.93     404.81     393.09     3.09   22
78.93      29.47        387.28       416.75     432.09     417.87     3.101  23
79.39      29.82        412.62       442.44     459.62     443.52     3.108  24
80.72      30.82        433.09       463.91     487.41     464.9      3.131  25
80.28      30.49        463.96       494.45     516.79     495.46     3.127  26
80.73      30.84        489.06       519.89     545.2      520.85     3.137  27
81.33      31.29        513.2        544.49     573.6      545.39     3.149  28
82.28      32.03        535.34       567.37     602.27     568.19     3.166  29
82.45      32.16        561.59       593.75     631.43     594.51     3.173  30
82.93      32.54        586.28       618.82     661.16     619.51     3.186  31
83.69      33.14        608.54       641.67     690.39     642.28     3.202  32
83.53      33.01        636.44       669.45     720.5      670        3.207  33
84.57      33.84        655.11       688.95     749.77     689.42     3.23   34
84.58      33.84        681.96       715.8      780.18     716.2      3.238  35
84.56      33.83        706.9        740.73     810        741.05     3.248  36
85.4       34.5         725.08       759.58     839.55     759.82     3.27   37
84.59      33.86        754.99       788.84     869.99     789.01     3.272  38
84.85      34.06        777.78       811.84     900.4      811.91     3.286  39
85.85      34.87        791.03       825.9      928.96     825.92     3.313  40
85.72      34.76        814.71       849.48     959.05     849.4      3.324  41
85.86      34.88        837.23       872.11     988.93     871.94     3.336  42
86.11      35.08        855.22       890.31     1018.71    890.04     3.356  43
86.55      35.44        870.64       906.08     1047.85    905.74     3.377  44
86.29      35.22        893.97       929.2      1077.47    928.76     3.387  45

H(M)            D(M)          POISSON'S RATIO
.01902          2.54E-03      .3
```

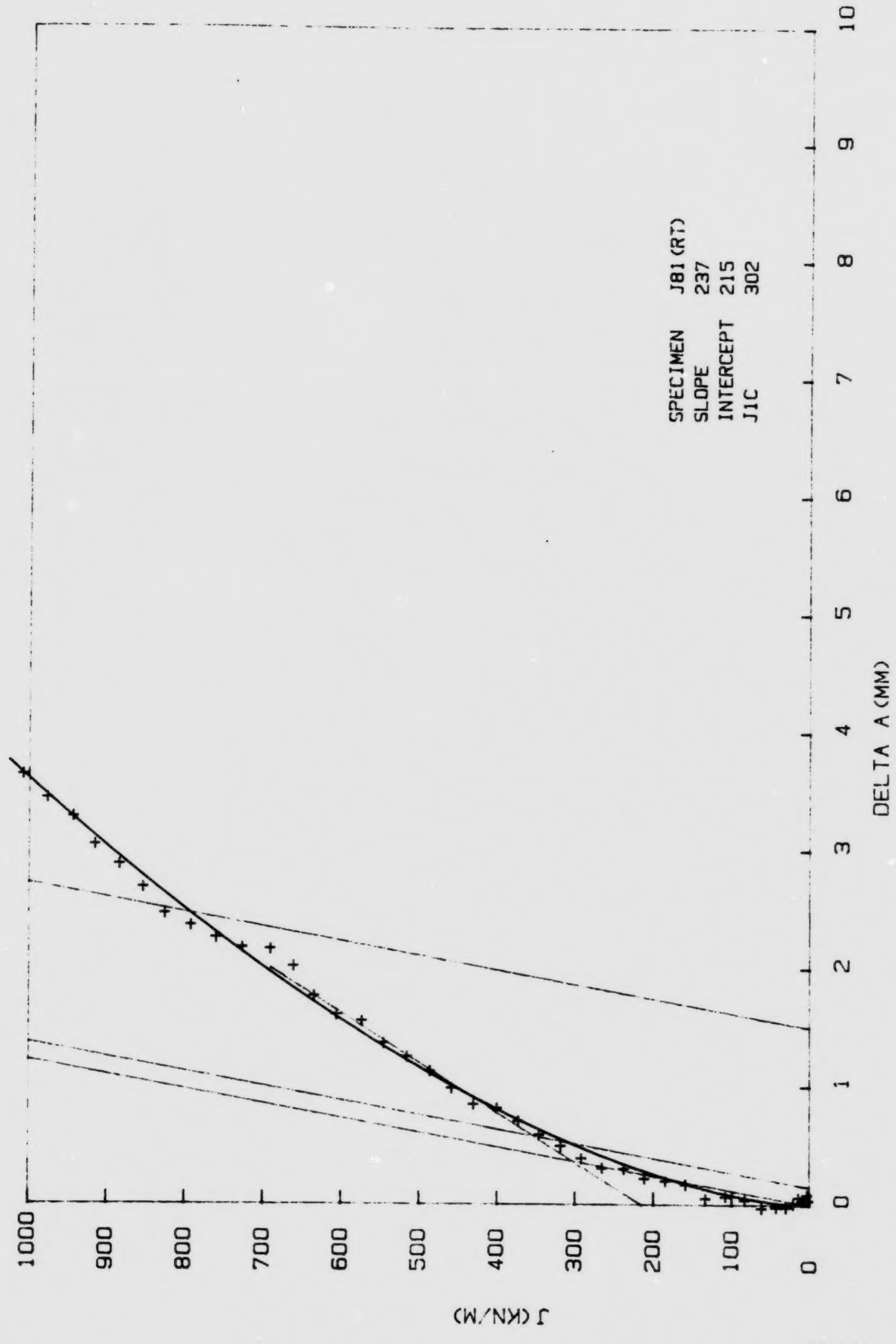
J80

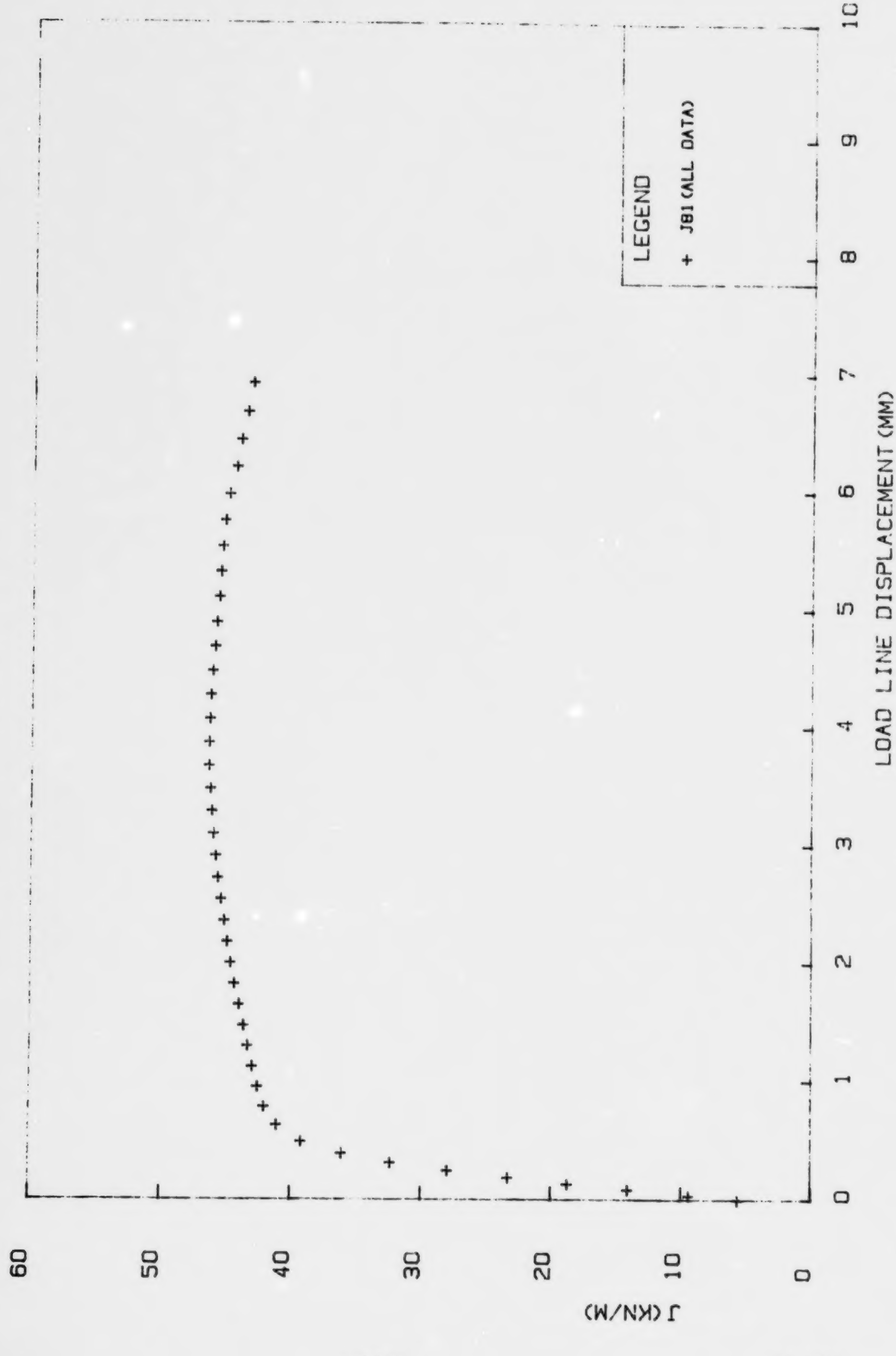
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.99	3.006	3.006	.088	.9993	1
2.47	3.005	3.005	.083	.9998	2
5.17	3.01	3.011	.137	.9998	3
9	3.008	3.009	.125	.9998	4
14.67	3.009	3.01	.134	.9998	5
23.95	3.003	3.005	.079	.9999	6
37.89	3.004	3.007	.098	.9999	7
58.23	3.012	3.016	.19	.9998	8
80.59	3.002	3.006	.094	.9998	9
103.08	3.001	3.007	.1	.9999	10
126.04	3.004	3.01	.132	.9999	11
148.79	3.007	3.015	.18	.9999	12
172.03	3.012	3.021	.238	.9999	13
195.75	3.018	3.027	.305	.9999	14
220.91	3.017	3.027	.304	.9996	15
243.97	3.031	3.043	.457	.9999	16
268.96	3.032	3.045	.482	.9998	17
296.1	3.023	3.037	.401	.9999	18
319.2	3.037	3.052	.548	.9999	19
343.24	3.048	3.064	.671	.9998	20
367.6	3.059	3.076	.795	.9998	21
391.93	3.072	3.09	.934	.9998	22
416.75	3.082	3.101	1.037	.9998	23
442.44	3.088	3.108	1.11	.9999	24
463.91	3.11	3.131	1.344	.9998	25
494.45	3.105	3.127	1.303	.9998	26
519.89	3.114	3.137	1.4	.9995	27
544.49	3.124	3.149	1.517	.9998	28
567.37	3.14	3.166	1.686	.9999	29
593.75	3.147	3.173	1.764	.9998	30
618.82	3.158	3.186	1.887	.9998	31
641.67	3.173	3.202	2.047	.9994	32
669.45	3.178	3.207	2.104	.9994	33
688.95	3.2	3.23	2.329	.9996	34
715.8	3.206	3.238	2.407	.9996	35
740.73	3.216	3.248	2.511	.9996	36
759.58	3.237	3.27	2.729	.9993	37
788.84	3.238	3.272	2.752	.9995	38
811.84	3.251	3.286	2.892	.9999	39
825.9	3.277	3.313	3.156	.9998	40
849.48	3.287	3.324	3.271	.9997	41
872.11	3.299	3.336	3.395	.9997	42
890.31	3.317	3.356	3.586	.9996	43
906.08	3.338	3.377	3.801	.9998	44
929.2	3.347	3.387	3.902	.9996	45

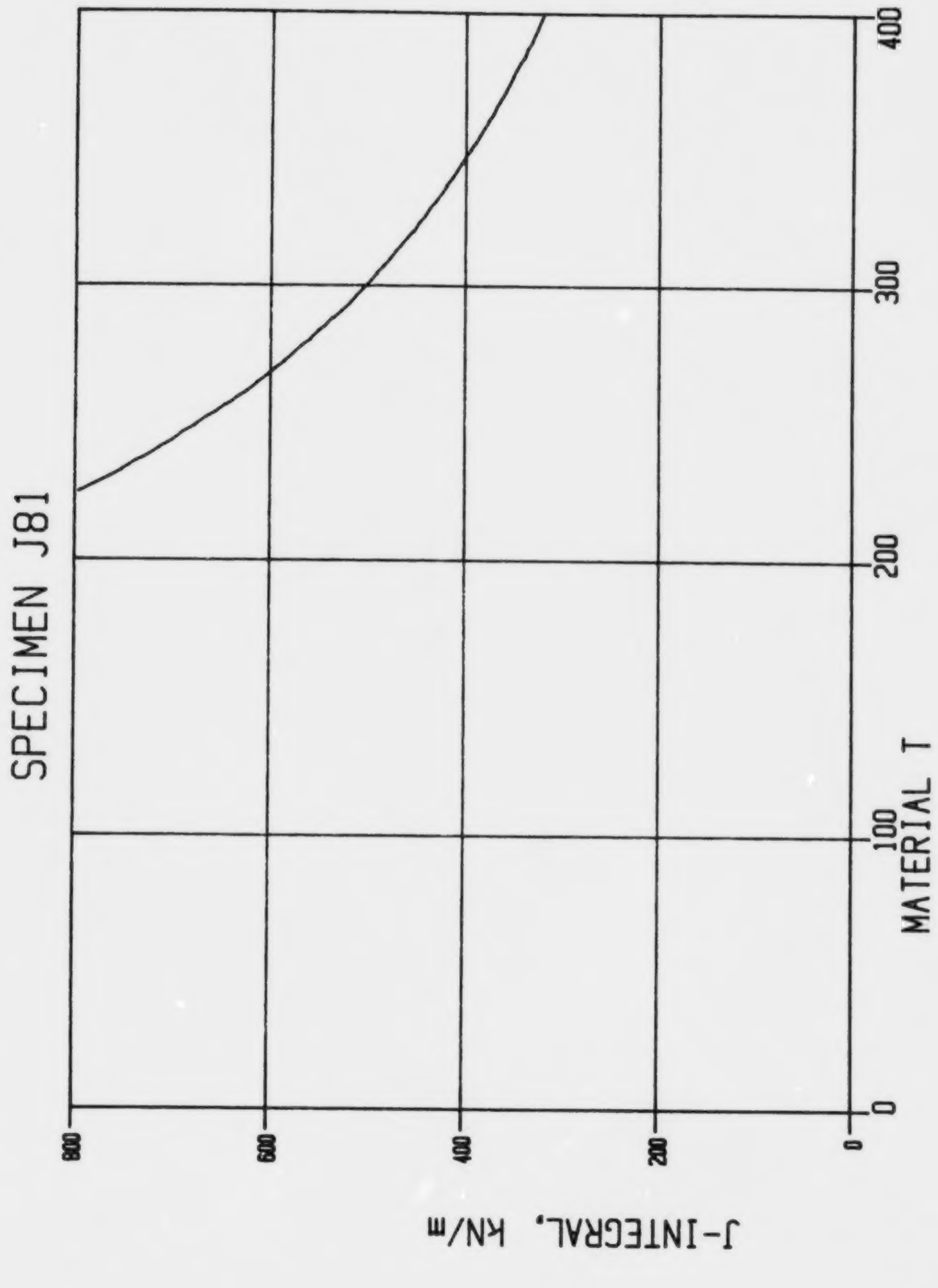
J80

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)
1	2.93	0
2	5.554	.034
3	8.85	.076
4	12.39	.127
5	15.93	.181
6	19.47	.244
7	22.461	.33
8	24.414	.444
9	25.146	.603
10	25.635	.767
11	26.001	.933
12	26.367	1.101
13	26.672	1.267
14	26.978	1.436
15	27.222	1.606
16	27.466	1.78
17	27.71	1.953
18	27.954	2.124
19	28.137	2.295
20	28.259	2.468
21	28.32	2.644
22	28.381	2.822
23	28.32	3.003
24	28.381	3.181
25	28.381	3.359
26	28.32	3.542
27	28.259	3.728
28	28.198	3.911
29	28.137	4.094
30	28.076	4.28
31	27.954	4.465
32	27.832	4.656
33	27.71	4.844
34	27.527	5.034
35	27.344	5.225
36	27.161	5.417
37	26.917	5.608
38	26.672	5.801
39	26.367	5.994
40	26.123	6.191
41	25.818	6.382
42	25.513	6.577
43	25.269	6.772
44	24.902	6.97
45	24.536	7.166
46	24.231	7.361

	J(KN/M)	T	W	J80
1	256.47	1118.87	77.85	
2	282.53	-383.56	-24.32	
3	307.65	179.62	10.38	
4	331.22	223.8	11.95	
5	355.42	223.8	11.06	
6	379.77	200.04	9.19	
7	404.34	273.78	11.75	
8	429.6	401.84	16.18	
9	453.18	105.01	3.96	
10	479.18	-867.08	-30.99	
11	507.17	300.67	10.1	
12	532.19	239.97	7.64	
13	555.93	154.44	4.66	
14	580.56	388.74	11.2	
15	606.29	232.45	6.37	
16	630.25	162.22	4.24	
17	655.56	563.28	14.11	
18	679.2	98.98	2.36	
19	702.38	389.23	8.95	
20	728.27	275.11	6.07	
21	750.16	98.71	2.09	
22	774.21	1444.31	29.58	
23	800.34	187.57	3.69	
24	818.87	60.77	1.15	
25	837.69	233.89	4.3	
26	860.79	208.41	3.7	
27	881.21	108.49	1.86	
28	898.19	84	1.4	
29	917.64	260.19	4.21	


SPECIMEN J81 (RT)
SLOPE 237
INTERCEPT 215
J1C 302
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ JB1 (ALL DATA)
J (KN/M)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN J81
MATERIAL T
0
100
200
300
400
J-INTEGRAL, kN/m
0
200
400
600
800

```
DATA SHEET-J1-R CURVE TEST

              TEST SPECIMEN DATA

SPECIMEN NUMBER                                       J81
MATERIAL TYPE                                         A106B
MATERIAL CONDITION                                    WELD(PN232)
TEST TEMPERATURE(DEG C)                               20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)             309
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)           512
CRACK PLANE ORIENTATION (PER ASTM E399)               L-C
SPECIMEN THICKNESS B(CM)                              3.032
PERCENT SIDE GROOVE                                   20.943
SPECIMEN WIDTH W(CM)                                  6.351
YOUNGS MODULUS AT TEST TEMP(Pa)                       1.92346E+11
EFFECTIVE MODULUS(Pa)                                 2.17737511E+11

              FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                 12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM              20.19
INITIAL CRACK LENGTH-COMPLIANCE(CM)                   3.671

              CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                        3.802
INITIAL A/W                                           .578
AVERAGE CRACK EXTENSION 9PT(CM)                       .408
DELTA A(CM) COMPLIANCE                                .363
MAX DEVIATION OF SINGLE MEASUREMENT %                 .79

              ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                          21
LAST POINT                           36
JIC(KN/M)                            302
CORRELATION COEFF                    .99
SLOPE M(MPa)                         237
INTERCEPT B (KN/M)                   215

              VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD             YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD                YES

              QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                              YES
CRACK SIZE DA<0.15*DELTA A                            YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                       491.98
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                     475.48
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                      2.68
25*JQ/EF.Y.(CM)                                       1.839

              CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED           21
LAST DATA POINT USED          42
CONSTANT(C1)                  455.77
EXPONENT(C2)                  .6135
```

J81(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
17.41	1.43	-.02	1.42	1.42	1.5	3.675	1
26.2	3.25	.04	3.29	3.29	3.48	3.68	2
34.72	5.7	.23	5.93	5.93	6.27	3.675	3
43.19	8.83	.83	9.66	9.66	10.18	3.675	4
51.88	12.73	1.87	14.6	14.6	15.36	3.678	5
59.84	16.94	4.35	21.29	21.29	22.3	3.672	6
66.6	20.99	9.35	30.33	30.32	31.59	3.669	7
72.36	24.77	18.35	43.11	43.1	44.6	3.669	8
75.82	27.19	34.75	61.94	61.93	63.57	3.668	9
77.94	28.74	54.92	83.66	83.77	85.35	3.675	10
78.97	29.51	78.63	108.14	108.32	109.86	3.678	11
79.69	30.05	103.48	133.52	133.64	135.29	3.677	12
80.92	30.98	127.88	158.86	159.58	160.62	3.688	13
81.62	31.51	152.93	184.44	185.32	186.22	3.691	14
82.41	32.13	179.22	211.35	212.4	213.15	3.693	15
83.5	32.99	204.43	237.41	239.2	239.22	3.702	16
84.09	33.45	231.61	265.06	266.87	266.9	3.702	17
84.97	34.16	257.55	291.71	294.5	293.54	3.71	18
85.95	34.95	283.24	318.19	322.29	320.02	3.72	19
86.9	35.73	309.98	345.71	351.13	347.53	3.73	20
87.99	36.63	335.87	372.49	379.75	374.31	3.742	21
88.91	37.4	362.98	400.38	409.45	402.19	3.752	22
89.43	37.84	392.54	430.38	440.02	432.19	3.755	23
90.42	38.68	419.71	458.39	470.77	460.18	3.769	24
91.47	39.58	446.65	486.23	501.71	487.99	3.784	25
92.38	40.38	475.21	515.59	533.79	517.32	3.796	26
93.03	40.95	504.59	545.54	566.49	547.24	3.807	27
94.01	41.81	531.74	573.55	599.43	575.2	3.826	28
94.19	41.97	564.16	606.14	633.46	607.76	3.831	29
94.88	42.59	592.57	635.16	667.1	636.72	3.847	30
96.02	43.62	617.93	661.55	701.25	663.04	3.873	31
96.66	44.2	646.98	691.18	735.61	692.62	3.887	32
96.34	43.91	683.5	727.42	772.25	728.82	3.888	33
96.59	44.14	716.59	760.73	808.49	762.09	3.896	34
96.98	44.5	748.41	792.91	844.65	794.22	3.907	35
97.22	44.71	781.3	826.01	881.68	827.25	3.917	36
97.96	45.4	808.71	854.11	918.96	855.26	3.939	37
98	45.44	838.92	884.36	957.58	885.37	3.958	38
98.41	45.81	870.06	915.87	996.61	916.79	3.975	39
98.86	46.24	897.55	943.79	1035.63	944.58	3.999	40
98.93	46.3	930.82	977.13	1076.6	977.79	4.014	41
99.15	46.51	961.81	1008.31	1118	1008.83	4.034	42

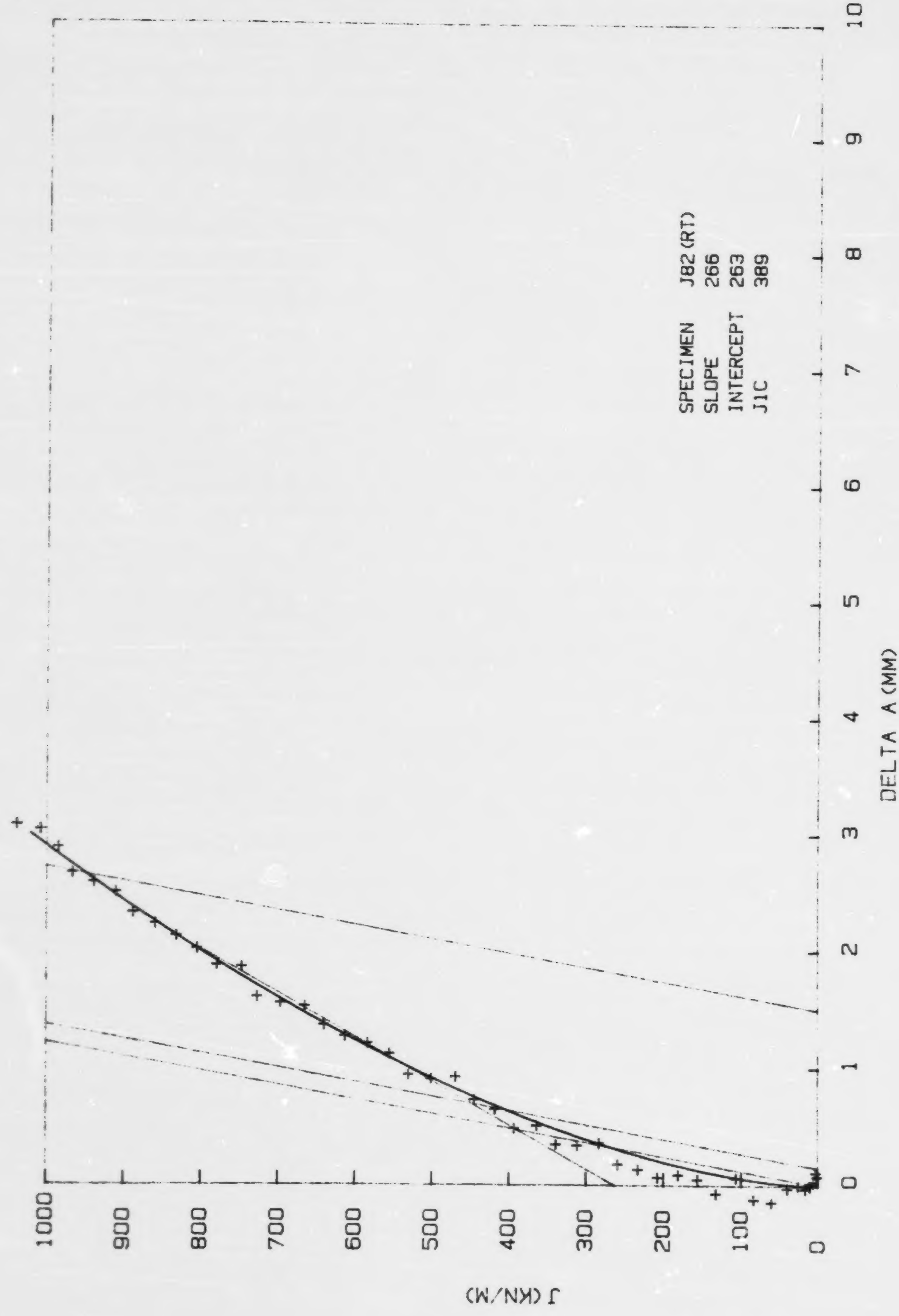
H(M)	D(M)	POISSON´S RATIO
.02381	2.54E-03	.3

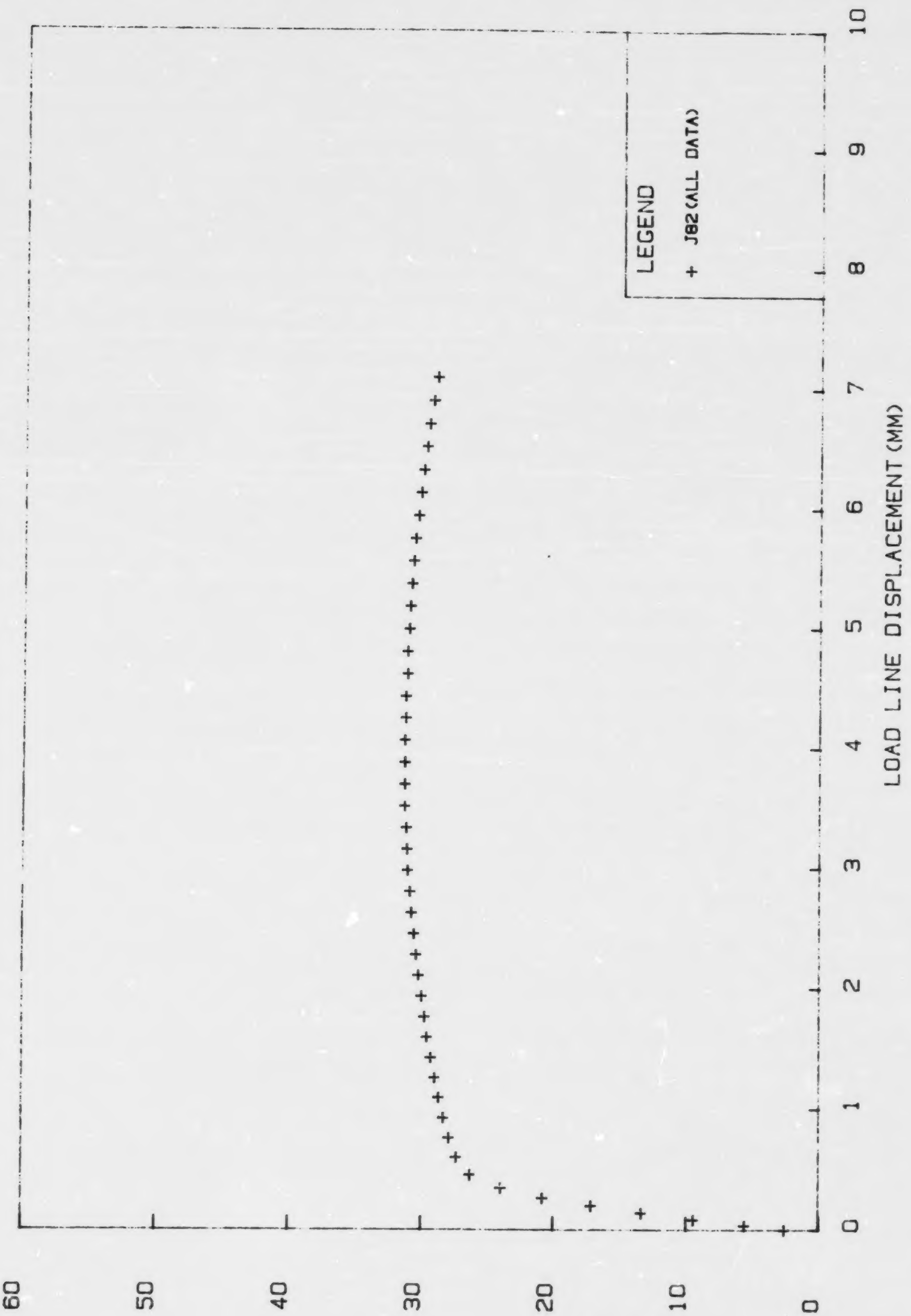
J81

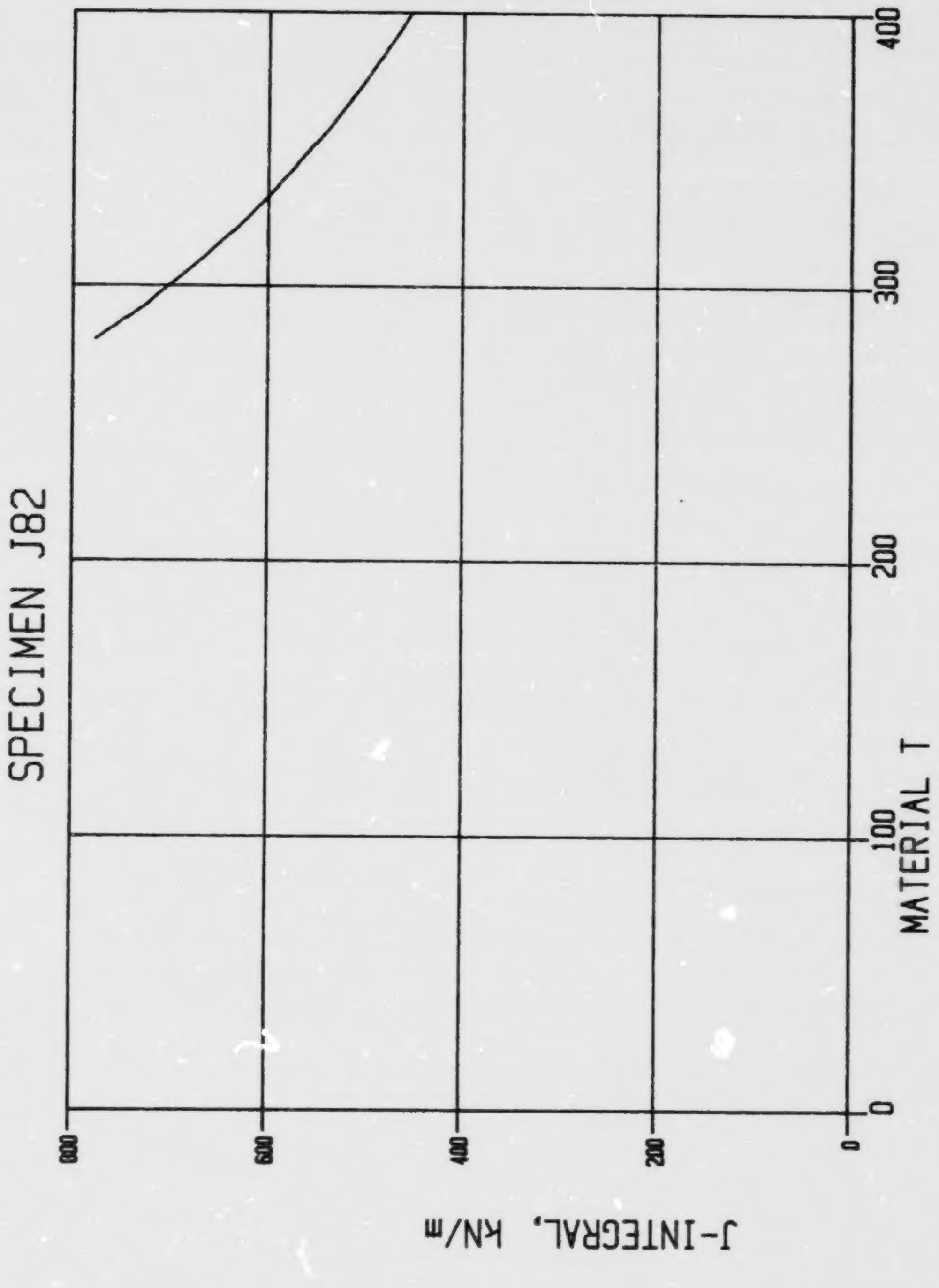
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.42	3.675	3.675	.04	.9997	1
3.29	3.679	3.68	.09	.9999	2
5.93	3.674	3.675	.042	1	3
9.66	3.674	3.675	.037	.9999	4
14.6	3.676	3.678	.067	.9999	5
21.29	3.67	3.672	.012	.9999	6
30.33	3.667	3.669	-.02	1	7
43.11	3.666	3.669	-.018	.9999	8
61.94	3.665	3.668	-.026	.9999	9
83.66	3.671	3.675	.045	.9999	10
108.14	3.673	3.678	.073	.9999	11
133.52	3.67	3.677	.057	.9999	12
158.86	3.681	3.688	.174	.9999	13
184.44	3.682	3.691	.2	.9998	14
211.35	3.683	3.693	.223	.9999	15
237.41	3.69	3.702	.305	.9998	16
265.06	3.69	3.702	.308	.9999	17
291.71	3.697	3.71	.392	.9998	18
318.19	3.706	3.72	.495	1	19
345.71	3.714	3.73	.588	.9999	20
372.49	3.725	3.742	.707	.9999	21
400.38	3.735	3.752	.814	.9999	22
430.38	3.736	3.755	.844	1	23
458.39	3.749	3.769	.983	1	24
486.23	3.763	3.784	1.129	.9999	25
515.59	3.774	3.796	1.249	.9998	26
545.54	3.784	3.807	1.362	.9999	27
573.55	3.802	3.826	1.552	1	28
606.14	3.806	3.831	1.605	.9999	29
635.16	3.82	3.847	1.763	.9999	30
661.55	3.845	3.873	2.016	1	31
691.18	3.858	3.887	2.162	.9999	32
727.42	3.858	3.888	2.173	.9999	33
760.73	3.865	3.896	2.255	.9997	34
792.91	3.874	3.907	2.36	.9999	35
826.01	3.883	3.917	2.46	.9999	36
854.11	3.904	3.939	2.681	.9999	37
884.36	3.922	3.958	2.875	.9999	38
915.87	3.937	3.975	3.042	.9999	39
943.79	3.96	3.999	3.278	.9999	40
977.13	3.974	4.014	3.434	.9999	41
1008.31	3.993	4.034	3.634	.9998	42

```
         LOAD(KN)     LOAD LINE DISPLACEMENT(MM)     J81
 1        5.615         0
 2        9.399          .037
 3       14.099          .085
 4       18.738          .134
 5       23.315          .188
 6       27.954          .247
 7       32.349          .313
 8       36.072          .391
 9       39.185          .491
10       41.077          .627
11       42.053          .781
12       42.542          .95
13       42.969         1.121
14       43.335         1.296
15       43.64          1.467
16       44.006         1.646
17       44.373         1.821
18       44.678         2
19       44.922         2.178
20       45.166         2.356
21       45.41          2.539
22       45.654         2.72
23       45.837         2.905
24       46.021         3.093
25       46.143         3.284
26       46.265         3.474
27       46.387         3.669
28       46.387         3.867
29       46.326         4.067
30       46.265         4.27
31       46.143         4.473
32       45.959         4.68
33       45.837         4.885
34       45.654         5.1
35       45.532         5.315
36       45.41          5.53
37       45.227         5.75
38       44.922         5.974
39       44.373         6.206
40       44.067         6.44
41       43.579         6.677
42       43.152         6.924
43       42.664         7.175
```

	J(KN/M)	T	W	J81
1	304.95	295.53	22.33	
2	331.95	335.06	23.18	
3	359.1	258.63	16.46	
4	386.44	297.58	17.53	
5	415.38	1109.82	60.75	
6	444.39	231.24	11.77	
7	472.31	217.65	10.36	
8	500.91	279.33	12.48	
9	530.56	301.99	12.68	
10	559.54	168.14	6.65	
11	589.84	704.75	26.37	
12	620.65	209.44	7.4	
13	648.35	119.2	3.99	
14	676.36	231.43	7.39	
15	709.3	3541.31	107.72	
16	744.07	466.46	13.48	
17	776.82	349.05	9.62	
18	809.46	379.65	10	
19	840.06	144.84	3.64	
20	869.23	178.16	4.3	
21	900.11	215.99	4.99	
22	929.83	135.02	2.99	
23	960.46	243.55	5.19	
24	992.72	177.82	3.64	


SPECIMEN J82(RT)
SLOPE 266
INTERCEPT 263
J1C 389
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J82 (ALL DATA)

SPECIMEN J82
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	J82
MATERIAL TYPE	A106B
MATERIAL CONDITION	WELD(PN232)
TEST TEMPERATURE(DEG C)	20
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	309
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	512
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	2.541
PERCENT SIDE GROOVE	20.346
SPECIMEN WIDTH W(CM)	5.081
YOUNGS MODULUS AT TEST TEMP(Pa)	1.92346E+11
EFFECTIVE MODULUS(Pa)	2.19673092E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	22.3
INITIAL CRACK LENGTH-COMPLIANCE(CM)	2.984

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.099
INITIAL A/W	.587
AVERAGE CRACK EXTENSION 9PT(CM)	.335
DELTA A(CM) COMPLIANCE	.308
MAX DEVIATION OF SINGLE MEASUREMENT %	1.5

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	23
LAST POINT	42
JIC(KN/M)	389
CORRELATION COEFF	.99
SLOPE M(MPa)	266
INTERCEPT B (KN/M)	263

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	NO
LIGAMENT>25JIC/EFFECTIVE YIELD	NO
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	415.43
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	367.25
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.097
25*JQ/EF.Y.(CM)	2.369

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	23
LAST DATA POINT USED	45
CONSTANT(C1)	526.78
EXPONENT(C2)	.6024

```
           J82(RT)

K          J-ELASTIC      J-PLASTIC     JEL+JPL      J(M)        J(TO.AREA)   CR. LN
(MPaRTM)   (KN/M)         (KN/M)        (KN/M)      (KN/M)          (KN/M)       (CM)

14.37      .98            -.02          .95          .95         1          2.992   1
24.27      2.79           -.02          2.77         2.77        2.92       2.996   2
34.08      5.49           .35           5.84         5.84        6.17       2.987   3
43.61      9              1.32          10.32        10.32       10.87      2.984   4
52.84      13.21          3.41          16.62        16.61       17.42      2.982   5
61.01      17.61          8.4           26.01        26.01       27.07      2.984   6
66.8       21.11          18.84         39.95        39.94       41.23      2.982   7
68.83      22.41          38.34         60.75        60.6        62.18      2.97    8
70.33      23.4           60.27         83.67        83.58       85.15      2.972   9
72.4       24.8           81.9          106.69       107.3       108.12     2.991   10
72.6       24.94          107.55        132.49       132.39      134.02     2.977   11
74.03      25.93          130.31        156.24       156.95      157.75     2.989   12
75.03      26.63          154.45        181.09       182.12      182.61     2.993   13
75.69      27.1           180.6         207.7        208.53      209.27     2.991   14
76.54      27.72          205.19        232.91       234.5       234.47     2.998   15
77.43      28.36          230.64        259          261.17      260.57     3.002   16
79.12      29.62          253.68        283.3        288.07      284.81     3.02    17
79.48      29.88          281.31        311.2        315.63      312.74     3.018   18
80         30.28          308.77        339.05       343.64      340.62     3.019   19
81.47      31.4           332.58        363.98       371.7       365.5      3.035   20
81.65      31.54          361.94        393.49       400.73      395.03     3.033   21
83.15      32.71          385.57        418.28       429.23      419.78     3.049   22
83.86      33.27          412.05        445.32       458.33      446.79     3.057   23
85.31      34.43          434.92        469.36       487.57      470.77     3.077   24
85.51      34.6           466.56        501.16       518.8       502.6      3.075   25
85.78      34.81          495.78        530.6        549.44      532.01     3.079   26
86.99      35.8           519.64        555.44       579.99      556.79     3.096   27
87.62      36.32          547.2         583.52       611.14      584.83     3.105   28
87.87      36.53          576.58        613.11       642.94      614.38     3.112   29
88.53      37.08          603.37        640.45       673.81      641.68     3.121   30
89.34      37.76          627.77        665.53       705.31      666.69     3.137   31
89.54      37.93          659.16        697.08       737.98      698.23     3.14    32
89.55      37.94          689.53        727.46       770.54      728.56     3.145   33
91.29      39.43          708.09        747.52       802.51      748.57     3.171   34
91.03      39.2           740.71        779.92       835.51      780.94     3.172   35
91.73      39.81          765.43        805.24       867.82      806.19     3.186   36
92.23      40.24          792.1         832.34       900.77      833.23     3.197   37
92.29      40.29          819.51        859.81       933.77      860.61     3.207   38
92.46      40.44          847.53        887.97       967.16      888.71     3.217   39
93.29      41.17          869.05        910.22       999.64      910.9      3.234   40
93.19      41.09          897.6         938.69       1033.08     939.28     3.243   41
93.25      41.14          925.55        966.69       1066        967.21     3.251   42
94.05      41.85          943.29        985.14       1098.47     985.6      3.272   43
94.35      42.11          966.08        1008.19      1131.72     1008.56 3.288      44
93.88      41.7           997.16        1038.86      1165.09     1039.15 3.292      45

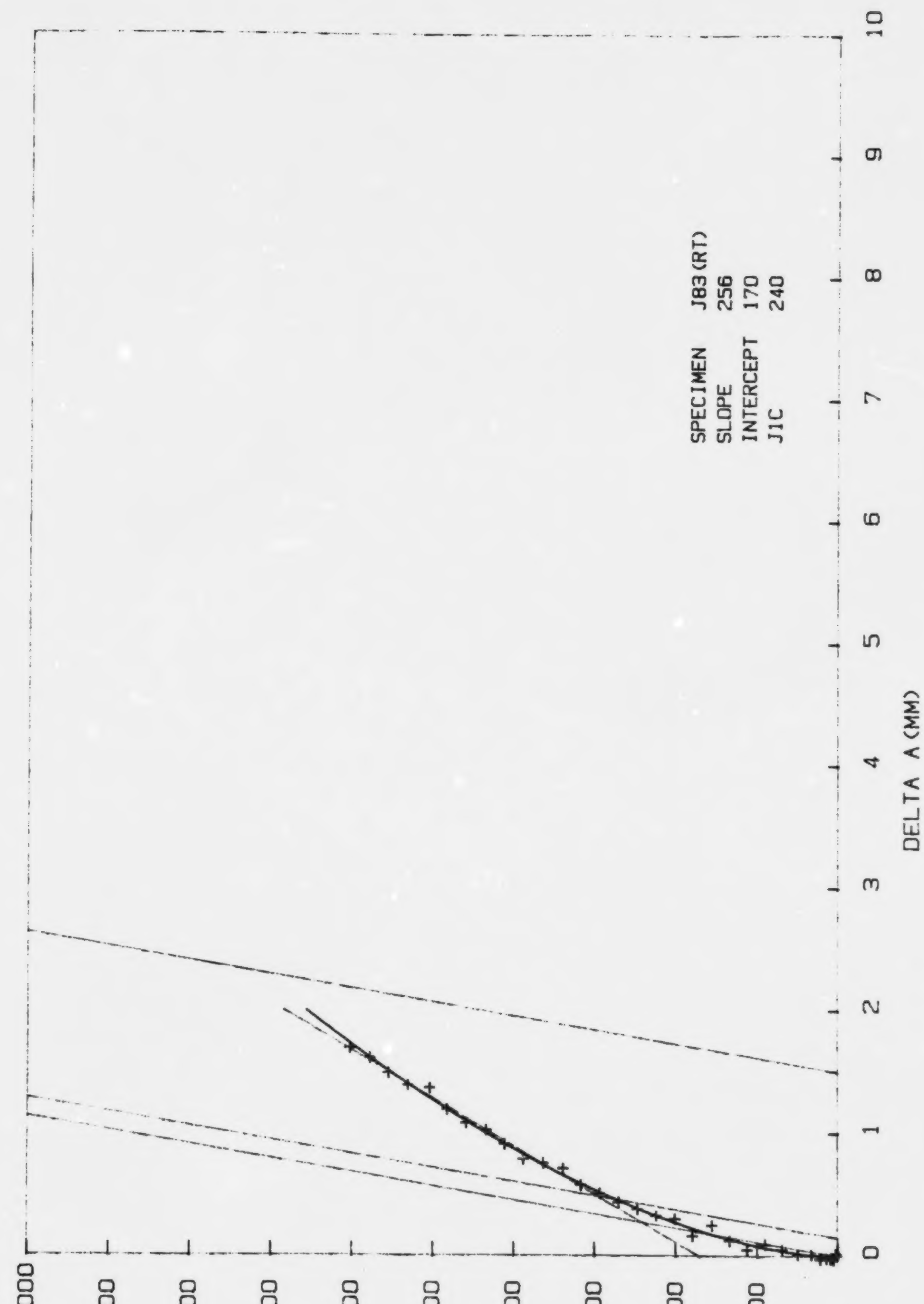
H(M)            D(M)            POISSON'S RATIO
.01904          2.54E-03        .3
```

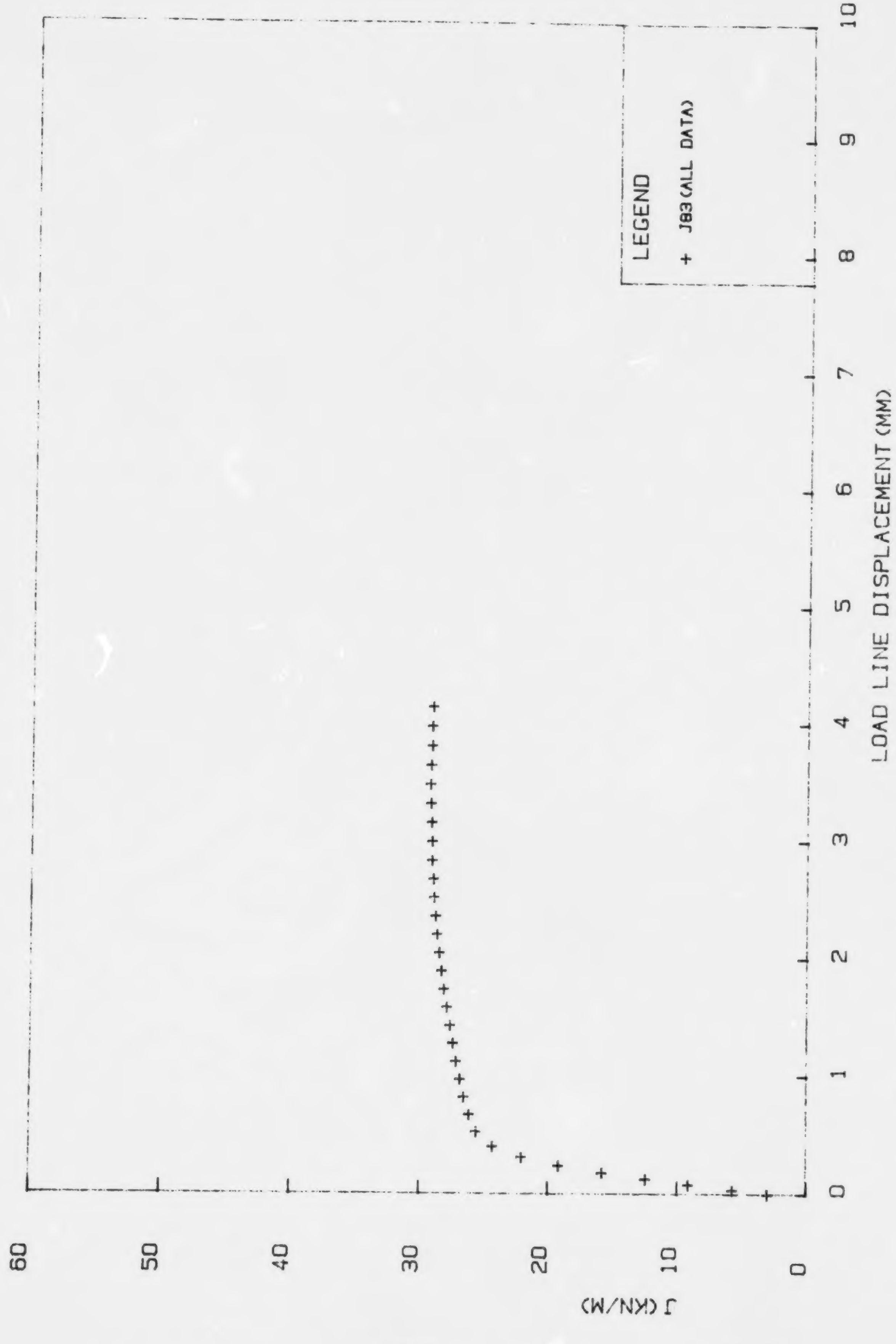
J82

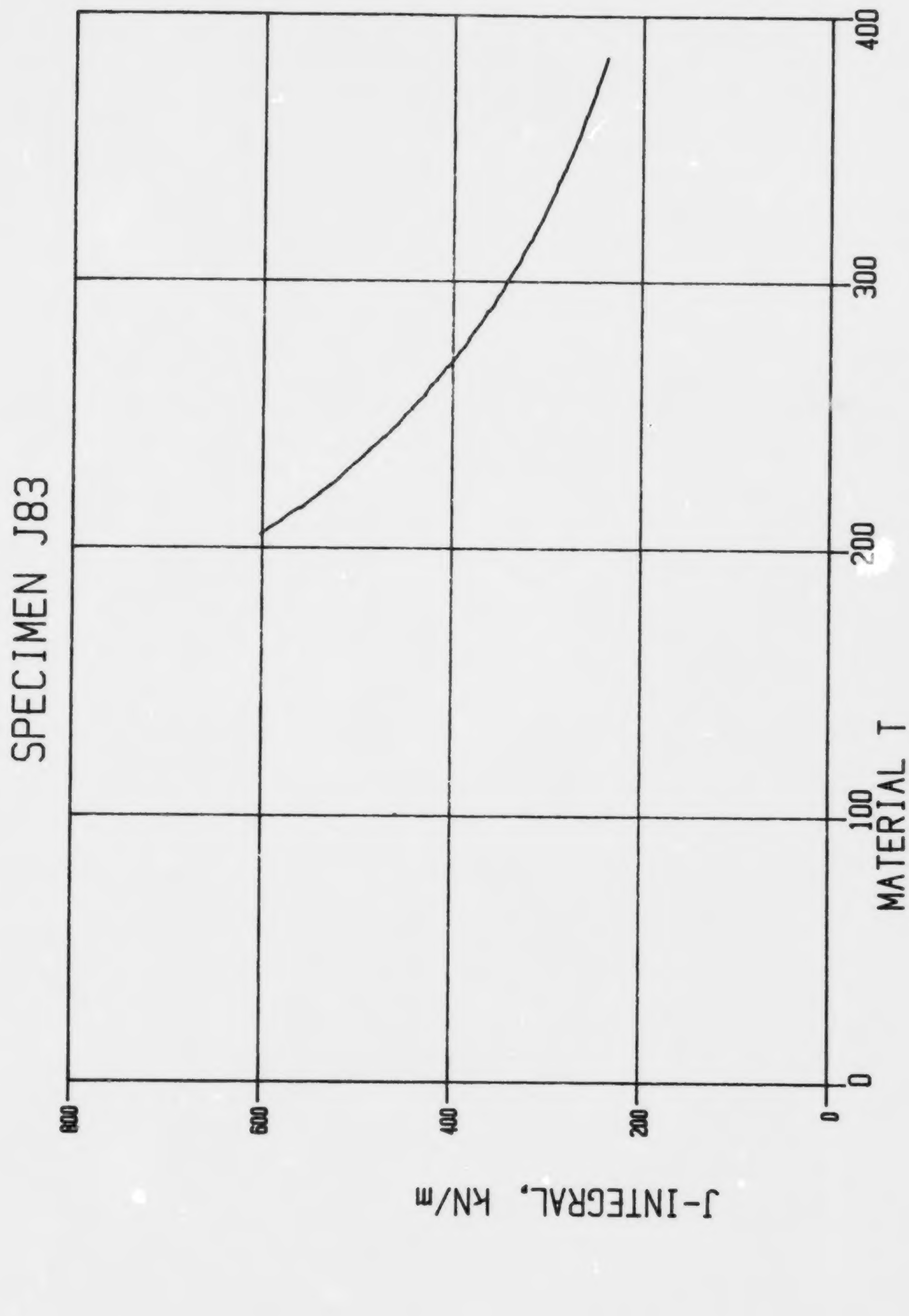
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.95	2.992	2.992	.079	.9996	1
2.77	2.995	2.996	.116	.9998	2
5.84	2.986	2.987	.031	.9998	3
10.32	2.982	2.984	-3E-03	.9999	4
16.62	2.98	2.982	-.025	.9999	5
26.01	2.982	2.984	2E-03	.9998	6
39.95	2.979	2.982	-.022	.9999	7
60.75	2.966	2.97	-.139	.9994	8
83.67	2.968	2.972	-.116	.9998	9
106.69	2.985	2.991	.069	.9996	10
132.49	2.971	2.977	-.067	.9995	11
156.24	2.982	2.989	.053	.9997	12
181.09	2.985	2.993	.093	.9999	13
207.7	2.981	2.991	.071	.9997	14
232.91	2.987	2.998	.138	.9998	15
259	2.99	3.002	.183	.9999	16
283.3	3.007	3.02	.362	.9999	17
311.2	3.004	3.018	.341	.9998	18
339.05	3.004	3.019	.35	.9996	19
363.98	3.019	3.035	.509	.9996	20
393.49	3.015	3.033	.487	.9998	21
418.28	3.03	3.049	.648	.9996	22
445.32	3.038	3.057	.731	.9996	23
469.36	3.056	3.077	.927	.9995	24
501.16	3.053	3.075	.907	.9998	25
530.6	3.056	3.079	.947	.9998	26
555.44	3.073	3.096	1.124	.9999	27
583.52	3.081	3.105	1.215	.9999	28
613.11	3.086	3.112	1.276	.9998	29
640.45	3.094	3.121	1.369	.9998	30
665.53	3.109	3.137	1.531	.9999	31
697.08	3.11	3.14	1.557	.9998	32
727.46	3.114	3.145	1.607	.9998	33
747.52	3.139	3.171	1.866	.9999	34
779.92	3.139	3.172	1.879	.9998	35
805.24	3.152	3.186	2.019	.9999	36
832.34	3.163	3.197	2.132	.9998	37
859.81	3.172	3.207	2.235	.9997	38
887.97	3.18	3.217	2.328	.9997	39
910.22	3.197	3.234	2.504	.9999	40
938.69	3.204	3.243	2.587	.9999	41
966.69	3.211	3.251	2.666	.9996	42
985.14	3.232	3.272	2.883	.9999	43
1008.19	3.246	3.288	3.037	.9997	44
1038.86	3.249	3.292	3.077	.9998	45

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J82
1	2.563	0	
2	5.615	.037	
3	9.46	.085	
4	13.367	.139	
5	17.151	.198	
6	20.813	.264	
7	23.987	.347	
8	26.306	.454	
9	27.344	.601	
10	27.893	.762	
11	28.32	.928	
12	28.687	1.094	
13	28.992	1.26	
14	29.297	1.426	
15	29.602	1.597	
16	29.785	1.765	
17	30.029	1.936	
18	30.273	2.109	
19	30.457	2.28	
20	30.64	2.454	
21	30.823	2.629	
22	30.945	2.805	
23	31.128	2.981	
24	31.189	3.157	
25	31.25	3.335	
26	31.372	3.518	
27	31.372	3.699	
28	31.372	3.882	
29	31.372	4.065	
30	31.311	4.25	
31	31.311	4.431	
32	31.189	4.617	
33	31.189	4.805	
34	31.067	4.993	
35	31.006	5.183	
36	30.884	5.371	
37	30.762	5.559	
38	30.64	5.75	
39	30.396	5.94	
40	30.212	6.133	
41	30.029	6.323	
42	29.785	6.516	
43	29.602	6.707	
44	29.297	6.899	
45	28.992	7.095	
46	28.748	7.288	

	J(KN/M)	T	W	J82
1	378.73	-1528.05	-72.4	
2	405.88	176.59	7.75	
3	431.8	369.36	15.17	
4	457.34	140.18	5.38	
5	485.26	-1812.59	-65.65	
6	515.88	845.86	28.76	
7	543.02	159.83	5.12	
8	569.48	353.63	10.75	
9	598.31	549.64	15.85	
10	626.78	334.88	9.17	
11	652.99	177.69	4.63	
12	681.31	1345.09	33.58	
13	712.27	695.22	16.56	
14	737.49	88.27	2	
15	763.72	2901.41	63.54	
16	792.58	206.34	4.32	
17	818.79	274.42	5.53	
18	846.07	305.38	5.92	
19	873.89	344.78	6.44	
20	899.1	144.36	2.6	
21	924.46	391.71	6.82	
22	952.69	404.57	6.81	
23	975.92	96.8	1.57	
24	996.66	170.73	2.69	
25	1023.52	886.23	13.57	


SPECIMEN J83(RT)
SLOPE 256
INTERCEPT 170
J1C 240
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ J83(ALL DATA)
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
J (KN/M)
0
10
20
30
40
50
60


SPECIMEN J83
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                  TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      J83
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   WELD(PN229)
 TEST TEMPERATURE(DEG C)                              20
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            367
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          516
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             2.541
 PERCENT SIDE GROOVE                                  21.645
 SPECIMEN WIDTH W(CM)                                 5.089
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.92346E+11
 EFFECTIVE MODULUS(Pa)                                2.09591166E+11

                  FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                10
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             22.91
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.026

                  CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.093
 INITIAL A/W                                          .595
 AVERAGE CRACK EXTENSION 9PT(CM)                      .176
 DELTA A(CM) COMPLIANCE                               .169
 MAX DEVIATION OF SINGLE MEASUREMENT %                1.4

                  ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                         19
 LAST POINT                          32
 JIC(KN/M)                           240
 CORRELATION COEFF                   .99
 SLOPE M(MPa)                        256
 INTERCEPT B (KN/M)                  170

                  VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD            YES
 LIGAMENT>25JIC/EFFECTIVE YIELD      YES
 DJ/DA<EFFECTIVE YIELD               YES

                  QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      439.51
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    418.09
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.063
 25*JQ/EF.Y.(CM)                                      1.359

                  CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED           19
 LAST DATA POINT USED          32
 CONSTANT(C1)                  433.93
 EXPONENT(C2)                  .5969
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J83(RT)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
15.13	1.08	.01	1.09	1.09	1.17	3.027	1
24.17	2.76	.03	2.79	2.79	2.98	3.029	2
32.76	5.08	.27	5.34	5.34	5.7	3.024	3
41.59	8.18	1.03	9.21	9.21	9.78	3.024	4
50.45	12.04	2.42	14.46	14.46	15.28	3.025	5
57.96	15.9	6.29	22.19	22.19	23.28	3.024	6
64.08	19.43	13.85	33.28	33.3	34.6	3.027	7
67.47	21.54	28.16	49.7	49.71	51.16	3.028	8
69.14	22.62	46.91	69.52	69.61	71.04	3.032	9
70.5	23.51	67.07	90.58	90.8	92.13	3.036	10
71.06	23.89	88.83	112.72	112.74	114.32	3.031	11
72.28	24.71	109.42	134.13	134.57	135.74	3.039	12
73.61	25.64	129.99	155.63	156.93	157.23	3.051	13
73.79	25.76	153.64	179.4	180	181.07	3.043	14
75.24	26.78	174.01	200.79	202.74	202.44	3.056	15
76.04	27.35	196.57	223.93	226.15	225.6	3.059	16
76.85	27.94	219.05	246.99	249.87	248.66	3.064	17
77.69	28.55	241.37	269.92	273.6	271.6	3.07	18
78.61	29.24	263.87	293.11	297.89	294.79	3.077	19
79.36	29.8	286.67	316.47	322.39	318.14	3.084	20
80.55	30.7	307.72	338.41	346.84	340.06	3.097	21
81.01	31.05	331.85	362.89	372.22	364.53	3.102	22
81.53	31.45	356.38	387.83	397.78	389.48	3.104	23
82.33	32.07	378.83	410.9	423.71	412.5	3.117	24
83.27	32.8	401.14	433.94	449.62	435.53	3.128	25
83.83	33.25	425.49	458.74	475.93	460.31	3.134	26
84.74	33.97	448.18	482.15	502.38	483.7	3.145	27
85.79	34.82	468.76	503.58	529.09	505.08	3.163	28
85.75	34.79	495.68	530.47	556.6	531.96	3.165	29
86.45	35.36	519.44	554.79	584.19	556.24	3.174	30
87.17	35.95	541.82	577.78	611.56	579.18	3.187	31
87.58	36.28	566.41	602.69	639.43	604.06	3.195	32

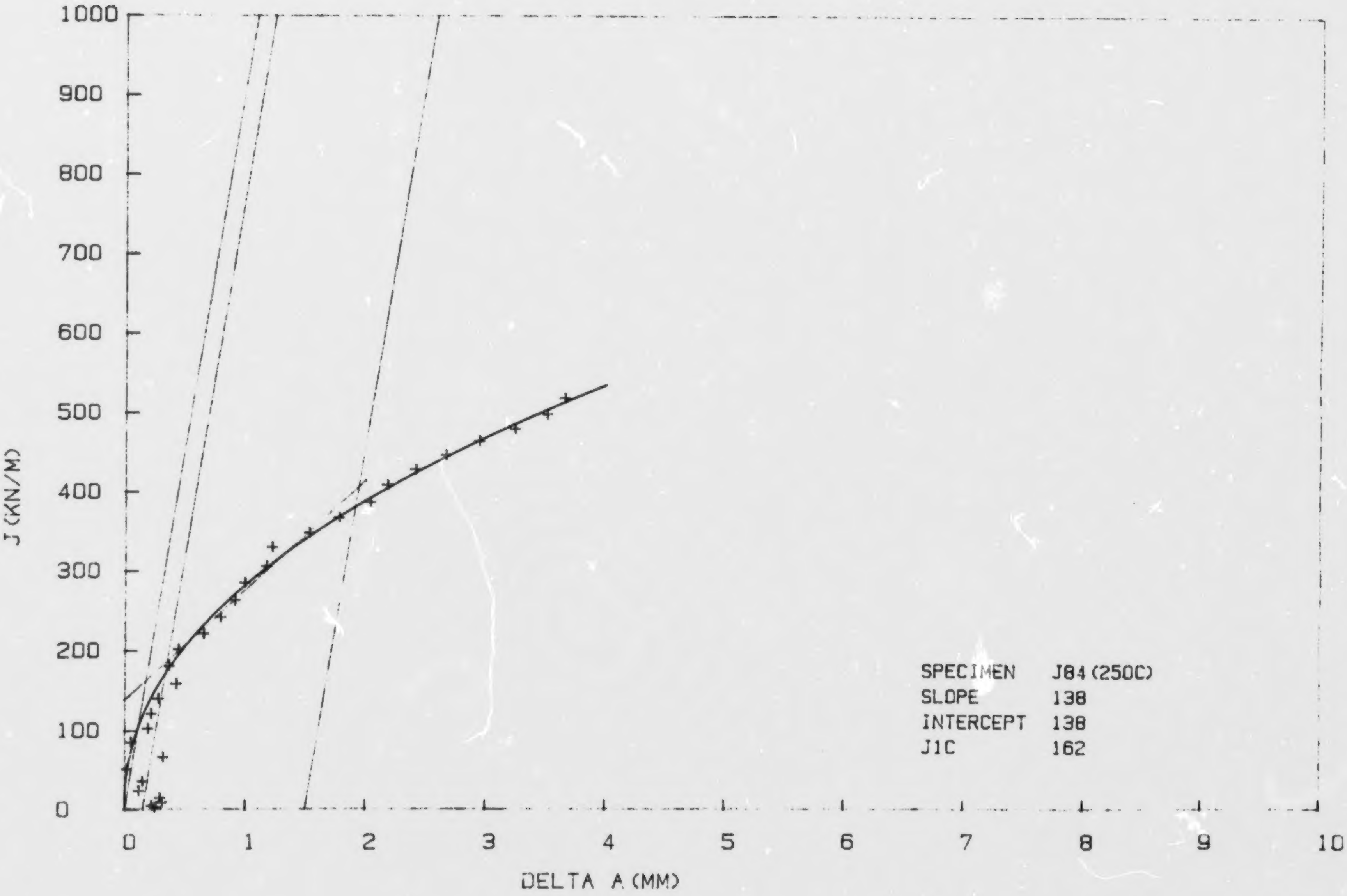
H(M)	D(M)	POISSON'S RATIO
.01906	2.54E-03	.3

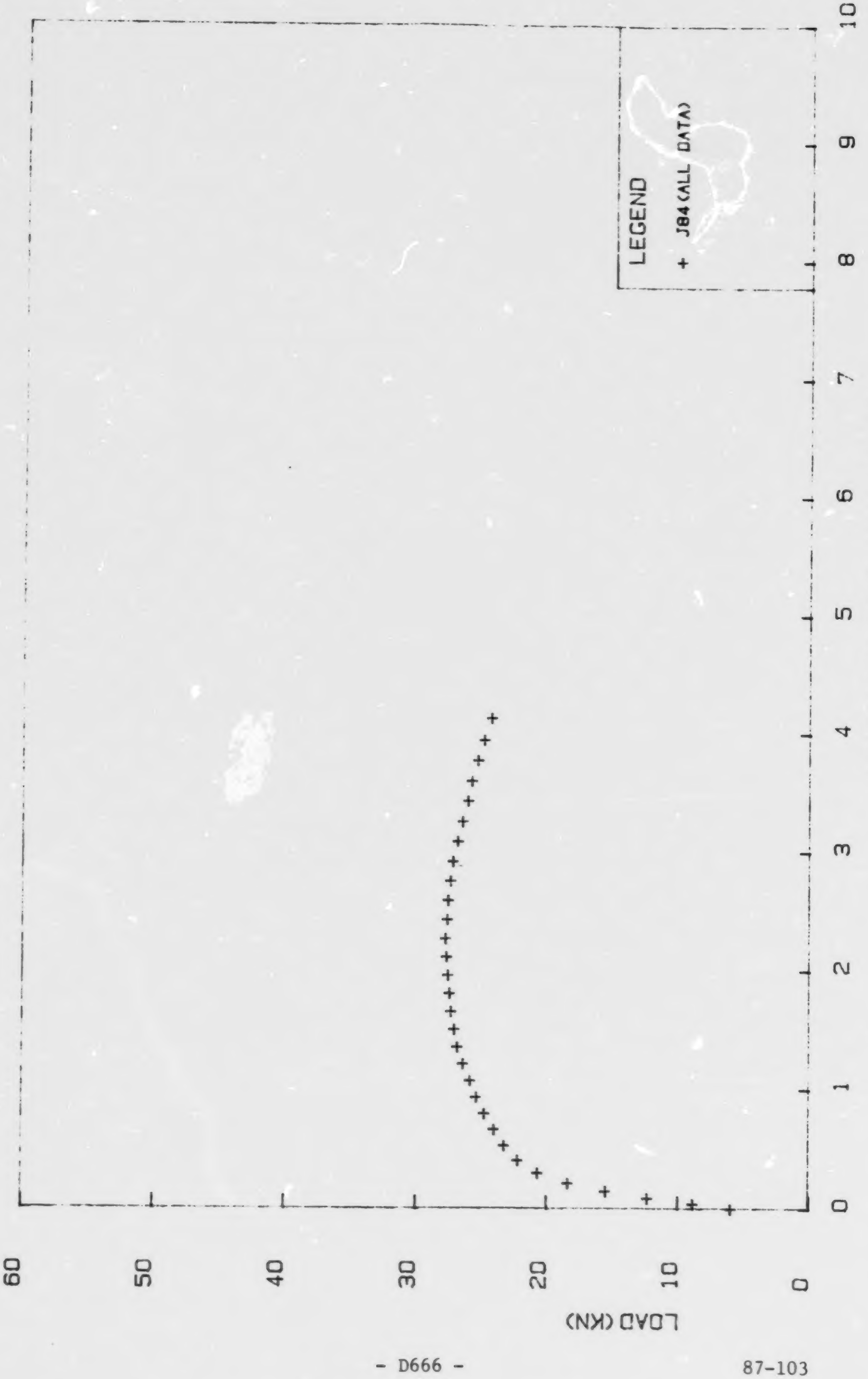
J83

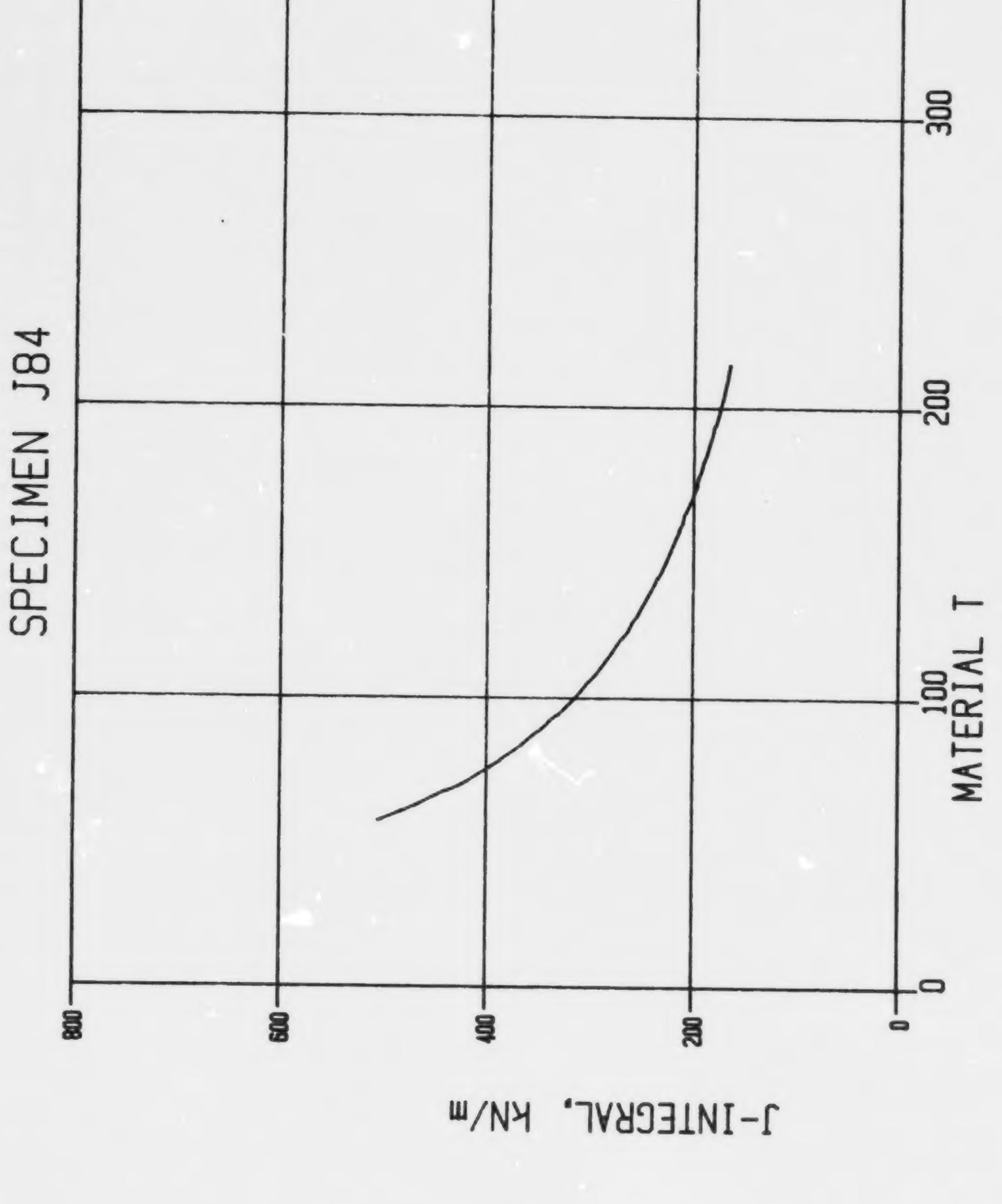
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.09	3.027	3.027	.01	.9999	1
2.79	3.028	3.029	.026	.9999	2
5.34	3.023	3.024	-.022	1	3
9.21	3.023	3.024	-.021	.9999	4
14.46	3.023	3.025	-.014	.9999	5
22.19	3.022	3.024	-.022	.9999	6
33.28	3.025	3.027	.015	.9999	7
49.7	3.024	3.028	.016	.9999	8
69.52	3.028	3.032	.057	.9999	9
90.58	3.031	3.036	.1	1	10
112.72	3.026	3.031	.054	.9999	11
134.13	3.032	3.039	.128	.9999	12
155.63	3.044	3.051	.251	1	13
179.4	3.034	3.043	.166	.9999	14
200.79	3.047	3.056	.305	1	15
223.93	3.049	3.059	.329	.9999	16
246.99	3.053	3.064	.382	.9998	17
269.92	3.058	3.07	.439	.9999	18
293.11	3.064	3.077	.509	.9999	19
316.47	3.07	3.084	.576	.9999	20
338.41	3.082	3.097	.711	.9998	21
362.89	3.086	3.102	.756	.9998	22
387.83	3.088	3.104	.785	.9999	23
410.9	3.099	3.117	.907	1	24
433.94	3.11	3.128	1.023	.9999	25
458.74	3.114	3.134	1.08	.9998	26
482.15	3.124	3.145	1.188	1	27
503.58	3.141	3.163	1.365	.9996	28
530.47	3.142	3.165	1.385	1	29
554.79	3.151	3.174	1.484	.9999	30
577.78	3.163	3.187	1.61	.9999	31
602.69	3.17	3.195	1.69	.9999	32

```
           LOAD(KN)     LOAD LINE DISPLACEMENT(MM)      J83
 1          2.991        0
 2          5.737         .037
 3          9.155         .082
 4          12.451        .128
 5          15.808        .182
 6          19.165        .24
 7          22.034        .313
 8          24.292        .404
 9          25.574        .527
 10         26.123        .671
 11         26.55         .822
 12         26.855        .973
 13         27.161        1.124
 14         27.405        1.278
 15         27.649        1.431
 16         27.893        1.584
 17         28.137        1.738
 18         28.32         1.893
 19         28.503        2.047
 20         28.687        2.203
 21         28.809        2.36
 22         28.931        2.516
 23         28.992        2.675
 24         29.114        2.833
 25         29.114        2.996
 26         29.175        3.157
 27         29.236        3.318
 28         29.297        3.48
 29         29.236        3.645
 30         29.175        3.81
 31         29.175        3.977
 32         29.114        4.143
 33         29.053        4.31
```

	J(KN/M)	T	W	J83
1	235.46	431.56	37.61	
2	258.45	397.41	31.46	
3	281.51	325.76	23.6	
4	304.79	344	22.94	
5	327.44	160.61	9.9	
6	350.65	535.56	30.76	
7	375.36	850.97	45.59	
8	399.36	185.6	9.29	
9	422.42	197.52	9.29	
10	446.34	426.38	18.93	
11	470.45	214.33	8.98	
12	492.87	119.06	4.72	
13	517.03	1346.95	50.81	
14	542.63	243.42	8.7	
15	566.28	180.18	6.13	
16	590.23	304.36	9.9	


SPECIMEN J84 (250C)
SLOPE 138
INTERCEPT 138
J1C 162
J (KN/M)
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
DELTA A (MM)


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J84 (ALL DATA)



SPECIMEN J84

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     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

SPECIMEN NUMBER                                          J84
MATERIAL TYPE                                            A106B
MATERIAL CONDITION                                       WELD(PN229)
TEST TEMPERATURE(DEG C)                                  250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)                364
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)              553.1
CRACK PLANE ORIENTATION (PER ASTM E399)                  L-C
SPECIMEN THICKNESS B(CM)                                 2.539
PERCENT SIDE GROOVE                                      21.15
SPECIMEN WIDTH W(CM)                                     5.09
YOUNGS MODULUS AT TEST TEMP(Pa)                          1.82776E+11
EFFECTIVE MODULUS(Pa)                                    1.98139622E+11

               FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN                    10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM                 22.34
INITIAL CRACK LENGTH-COMPLIANCE(CM)                      2.992

               CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                           3.079
INITIAL A/W                                              .588
AVERAGE CRACK EXTENSION 9PT(CM)                          .361
DELTA A(CM) COMPLIANCE                                   .366
MAX DEVIATION OF SINGLE MEASUREMENT %                    2.24

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                         14
LAST POINT                          23
JIC(KN/M)                           162
CORRELATION COEFF                   .97
SLOPE M(MPa)                        138
INTERCEPT B (KN/M)                  138

               VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD            YES
LIGAMENT>25JIC/EFFECTIVE YIELD      YES
DJ/DA<EFFECTIVE YIELD               YES

               QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                                 NO
CRACK SIZE DA<0.15*DELTA A                               YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                          459.01
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                        397.04
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                         2.098
25*JQ/EF.Y.(CM)                                          .883

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED       14
LAST DATA POINT USED      31
CONSTANT(C1)              283
EXPONENT(C2)              .4601
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J84(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
23.1	2.66	.04	2.7	2.7	2.8	3.017	1
32.12	5.14	.03	5.16	5.16	5.42	3.015	2
40.64	8.22	1.04	9.26	9.26	9.71	3.023	3
48.1	11.52	3.39	14.91	14.91	15.59	3.021	4
53.47	14.23	9.77	24.01	23.97	24.9	3.004	5
57.54	16.48	19.54	36.02	36	37.05	3.007	6
59.65	17.71	33.62	51.33	51.15	52.5	2.994	7
63.1	19.82	46.97	66.8	67.25	67.96	3.024	8
63.73	20.22	65.38	85.6	85.26	86.93	2.997	9
65.98	21.68	81.27	102.95	103.18	104.3	3.011	10
67.39	22.61	99.05	121.66	122.04	123.06	3.014	11
69.14	23.8	116.82	140.62	141.38	142.07	3.02	12
71.04	25.13	134.12	159.25	161.09	160.7	3.035	13
71.36	25.36	156.12	181.48	182.81	182.98	3.029	14
72.44	26.13	176.04	202.17	204.28	203.68	3.037	15
73.92	27.2	194.73	221.94	226.34	223.4	3.057	16
75.08	28.06	214.43	242.49	248.69	243.93	3.072	17
76.1	28.84	235.06	263.9	271.72	265.32	3.083	18
76.76	29.34	256.47	285.81	294.88	287.21	3.092	19
77.52	29.92	276.74	306.66	318.73	307.99	3.11	20
77.65	30.02	300.32	330.34	343.3	331.65	3.115	21
79.05	31.11	317.22	348.33	367.31	349.55	3.145	22
80.12	31.96	335.73	367.69	391.87	368.83	3.17	23
80.76	32.47	354.88	387.35	417.36	388.37	3.196	24
80.61	32.35	376.54	408.9	442.33	409.82	3.21	25
80.9	32.58	396.2	428.78	468.22	429.57	3.233	26
81.91	33.4	413.44	446.84	493.2	447.55	3.259	27
82.35	33.77	430.58	464.34	518.78	464.93	3.287	28
82.92	34.23	445.92	480.15	543.58	480.63	3.317	29
83.09	34.37	464.13	498.5	570.53	498.82	3.344	30
82.1	33.56	485.27	518.83	595.78	518.99	3.358	31

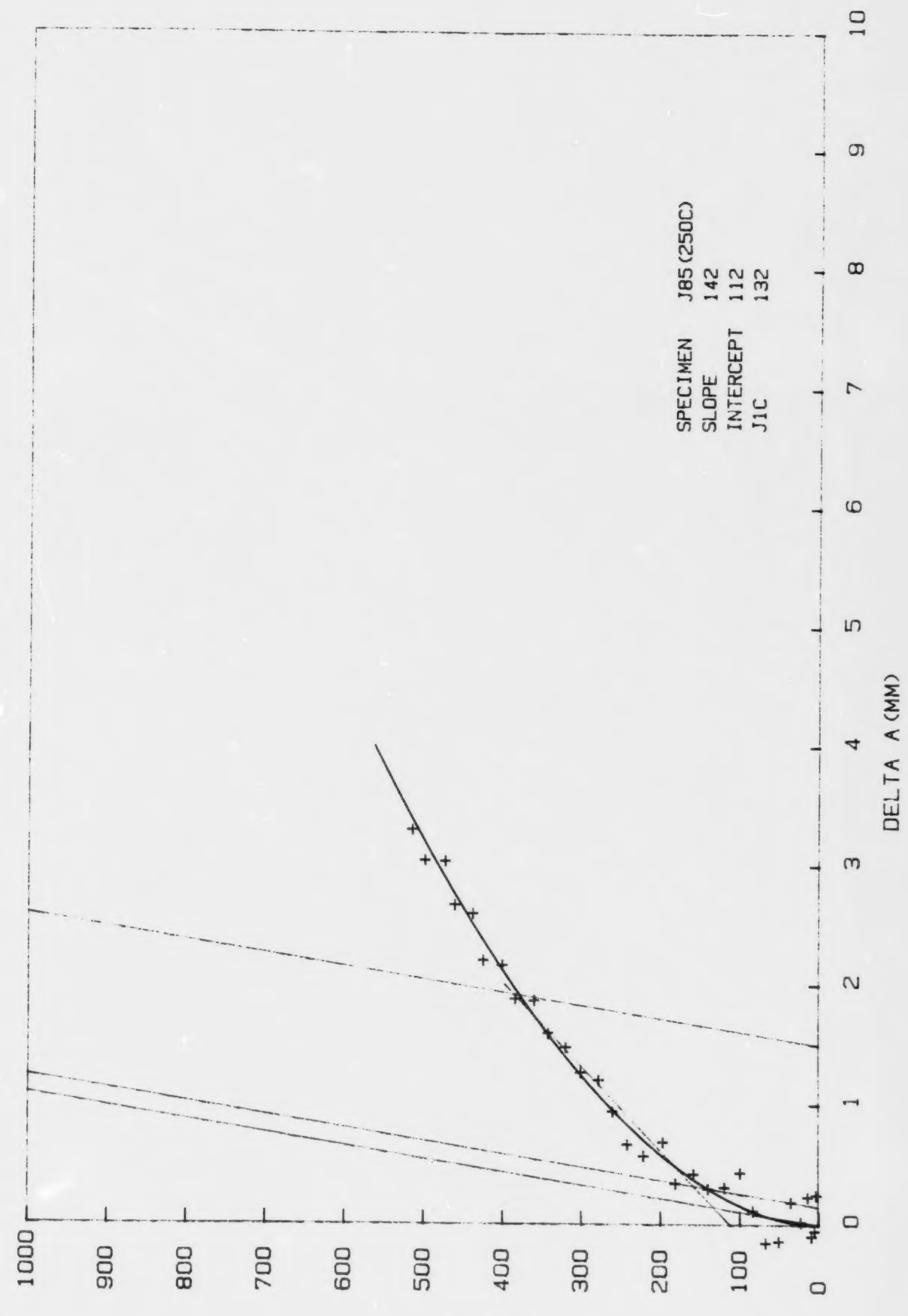
H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

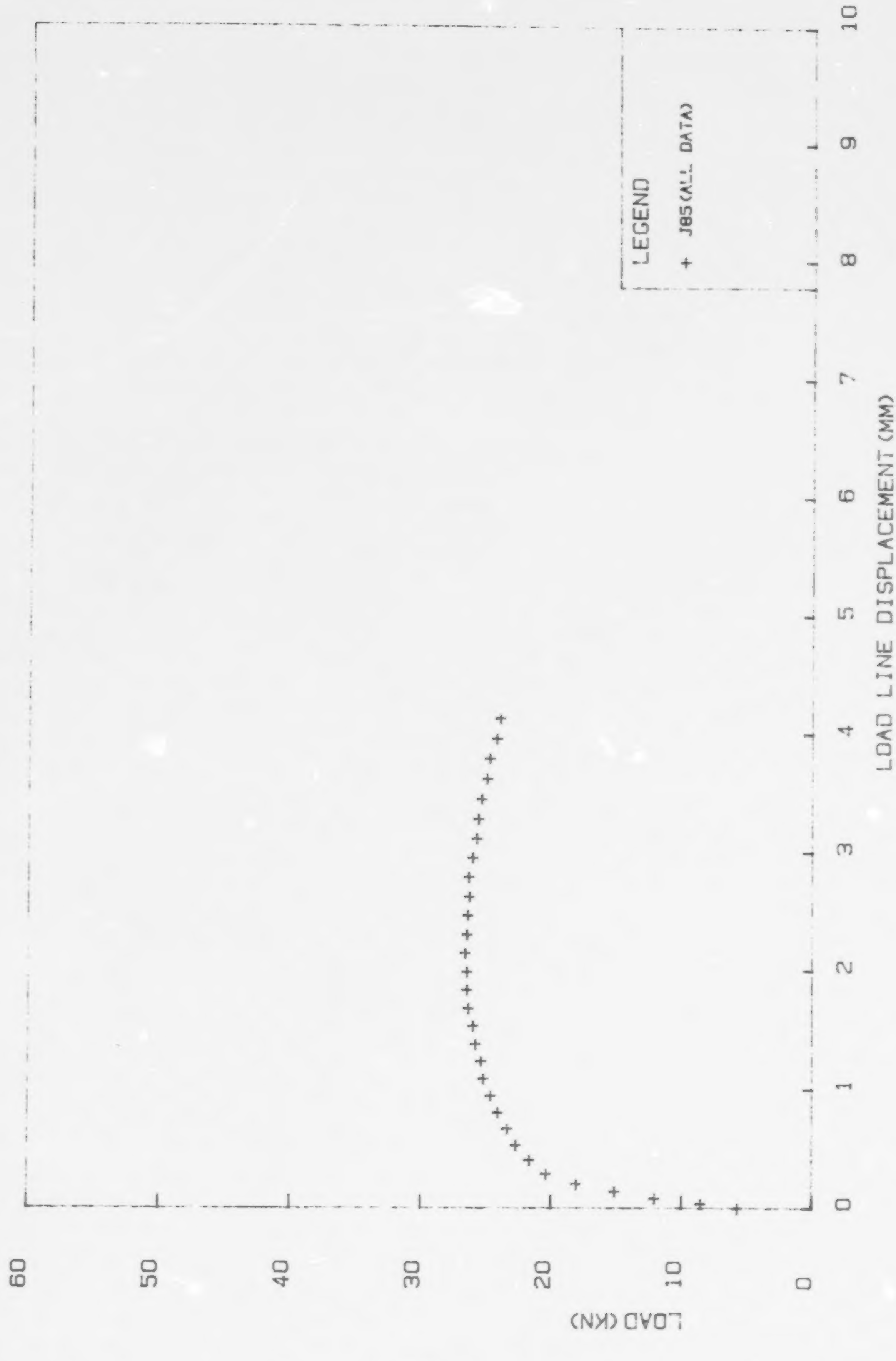
J84

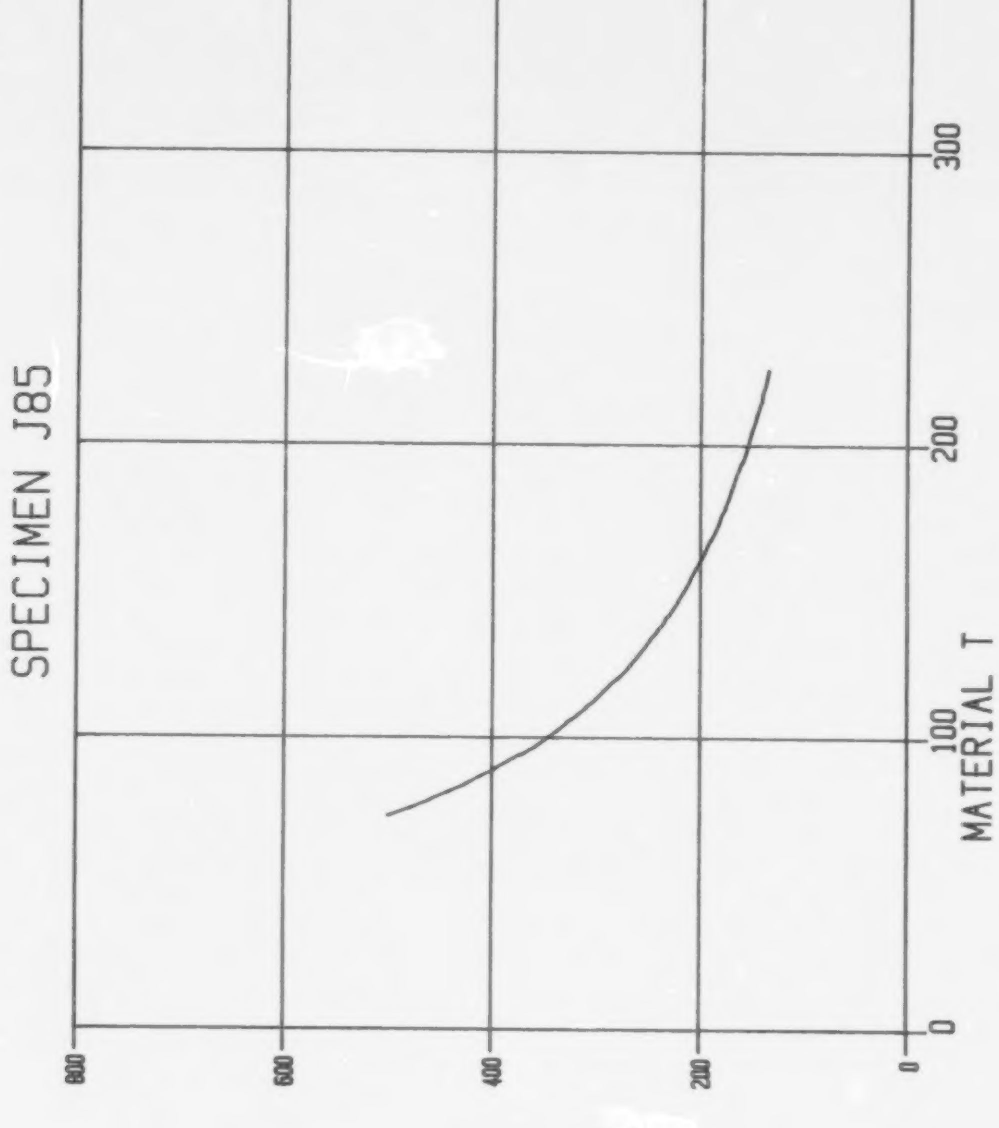
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.7	3.017	3.017	.251	.9979	1
5.16	3.014	3.015	.225	.9996	2
9.26	3.022	3.023	.311	.9994	3
14.91	3.02	3.021	.294	.9992	4
24.01	3.002	3.004	.119	.9993	5
36.02	3.004	3.007	.149	.9994	6
51.33	2.991	2.994	.02	.9997	7
66.8	3.02	3.024	.321	.9995	8
85.6	2.993	2.997	.055	.9998	9
102.95	3.006	3.011	.194	.9997	10
121.66	3.008	3.014	.222	.9995	11
140.62	3.013	3.02	.282	.9996	12
159.25	3.027	3.035	.429	.9998	13
181.48	3.02	3.029	.369	.9994	14
202.17	3.027	3.037	.449	.9995	15
221.94	3.047	3.057	.653	.9999	16
242.49	3.06	3.072	.797	.999	17
263.9	3.071	3.083	.914	.9991	18
285.81	3.078	3.092	.996	.9996	19
306.66	3.095	3.11	1.176	.9997	20
330.34	3.099	3.115	1.225	.9996	21
348.33	3.129	3.145	1.531	.9996	22
367.69	3.153	3.17	1.778	.9999	23
387.35	3.178	3.196	2.037	.9998	24
408.9	3.192	3.21	2.18	.9997	25
428.78	3.214	3.233	2.414	.9998	26
446.84	3.239	3.259	2.668	.9999	27
464.34	3.267	3.287	2.949	.9998	28
480.15	3.296	3.317	3.245	.9995	29
498.5	3.322	3.344	3.516	.9997	30
518.83	3.336	3.358	3.663	.9996	31

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J84
1	5.92	0	
2	8.85	.042	
3	12.329	.088	
4	15.503	.146	
5	18.372	.211	
6	20.691	.298	
7	22.217	.405	
8	23.254	.53	
9	24.048	.664	
10	24.78	.798	
11	25.391	.936	
12	25.879	1.075	
13	26.428	1.216	
14	26.855	1.357	
15	27.1	1.506	
16	27.344	1.655	
17	27.466	1.809	
18	27.588	1.962	
19	27.71	2.117	
20	27.771	2.271	
21	27.649	2.43	
22	27.588	2.592	
23	27.405	2.755	
24	27.222	2.92	
25	26.855	3.091	
26	26.489	3.256	
27	26.062	3.43	
28	25.818	3.6	
29	25.33	3.774	
30	24.841	3.945	
31	24.292	4.131	
32	23.682	4.303	

	J(KN/M)	T	W	J84
1	170.36	-322.08	-44.83	
2	191.82	226.91	27.94	
3	212.05	83.94	9.26	
4	232.21	124.37	12.44	
5	253.19	158.52	14.45	
6	274.85	231.9	19.4	
7	296.23	100.82	7.75	
8	318.5	418.32	29.85	
9	339.34	51.2	3.38	
10	358.01	68.06	4.2	
11	377.52	65.89	3.8	
12	398.12	131.75	7.16	
13	418.84	73.78	3.76	
14	437.81	61.83	2.98	
15	455.59	54.14	2.46	
16	472.25	46.32	2	
17	489.32	58.95	2.42	
18	508.66	120.22	4.71	


SPECIMEN J85(250C)
SLOPE 142
INTERCEPT 112
J1C 132
DELTA A (MM)
J (KN/M)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ J85(ALL DATA)


SPECIMEN J85
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

J85(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
22.55	2.53	-.01	2.52	2.52	2.62	3.029	1
31.17	4.84	.1	4.94	4.94	5.22	2.999	2
38.91	7.54	1.38	8.92	8.92	9.38	2.995	3
47.61	11.29	2.5	13.79	13.82	14.44	3.028	4
52.88	13.92	8.77	22.69	22.68	23.56	3.007	5
56.91	16.13	19.07	35.19	35.28	36.15	3.023	6
58.19	16.86	33.99	50.85	50.54	52	2.991	7
59.85	17.84	49.78	67.62	67.28	68.84	2.989	8
62.98	19.75	63.72	83.47	83.96	84.68	3.016	9
65.99	21.68	78.03	99.71	101.48	100.9	3.048	10
66.83	22.24	97.42	119.65	120.82	120.95	3.036	11
67.25	22.52	117.68	140.2	141.28	141.52	3.034	12
69.02	23.72	134.73	158.45	160.44	159.79	3.046	13
69.1	23.77	157.27	181.04	182.36	182.43	3.039	14
71.96	25.78	171.32	197.1	201.89	198.47	3.073	15
71.65	25.56	195.93	221.48	224.98	222.92	3.062	16
72.18	25.94	215.91	241.85	246.55	243.25	3.071	17
74.09	27.33	233.27	260.6	269.12	261.94	3.099	18
75.3	28.23	250.02	278.25	290.76	279.52	3.125	19
75.51	28.39	272.71	301.1	314.66	302.34	3.131	20
76.46	29.11	290.86	319.97	337.33	321.14	3.152	21
77.36	29.8	312.37	342.17	361.77	343.31	3.164	22
78.22	30.46	329.73	360.19	385.52	361.23	3.191	23
77.4	29.82	354.57	384.4	410.04	385.37	3.193	24
78.87	30.97	370.02	400.99	433.38	401.91	3.221	25
78.39	30.59	394.47	425.07	458.5	425.93	3.225	26
79.71	31.63	406.87	438.5	482.53	439.28	3.264	27
79.61	31.55	430.02	461.57	507.6	462.29	3.271	28
80.41	32.19	441.59	473.79	530.88	474.42	3.308	29
79.65	31.58	467.64	499.22	556.52	499.81	3.308	30
80.46	32.23	483.23	515.46	581.25	515.96	3.334	31

H(M)	D(M)	POISSON'S RATIO
.01905	2.54E-03	.3

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      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

SPECIMEN NUMBER                                    J85
MATERIAL TYPE                                      A106B
MATERIAL CONDITION                                 WELD(PN229)
TEST TEMPERATURE(DEG C)                            250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          364
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        553.1
CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
SPECIMEN THICKNESS B(CM)                           2.54
PERCENT SIDE GROOVE                                21.22
SPECIMEN WIDTH W(CM)                               5.087
YOUNGS MODULUS AT TEST TEMP(Pa)                    1.82776E+11
EFFECTIVE MODULUS(Pa)                              1.97482169E+11

                 FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN              10
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           22.57
INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.004

                 CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)                     3.088
INITIAL A/W                                        .591
AVERAGE CRACK EXTENSION 9PT(CM)                    .359
DELTA A(CM) COMPLIANCE                             .33
MAX DEVIATION OF SINGLE MEASUREMENT %              1.47

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT                  11
LAST POINT                   24
JIC(KN/M)                    132
CORRELATION COEFF            .95
SLOPE M(MPa)                 142
INTERCEPT B (KN/M)           112

                 VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD     YES
LIGAMENT>25JIC/EFFECTIVE YIELD YES
DJ/DA<EFFECTIVE YIELD        YES

                 QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY                           NO
CRACK SIZE DA<0.15*DELTA A                         YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    458.78
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  401.96
DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.083
25*JQ/EF.Y.(CM)                                    .72

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

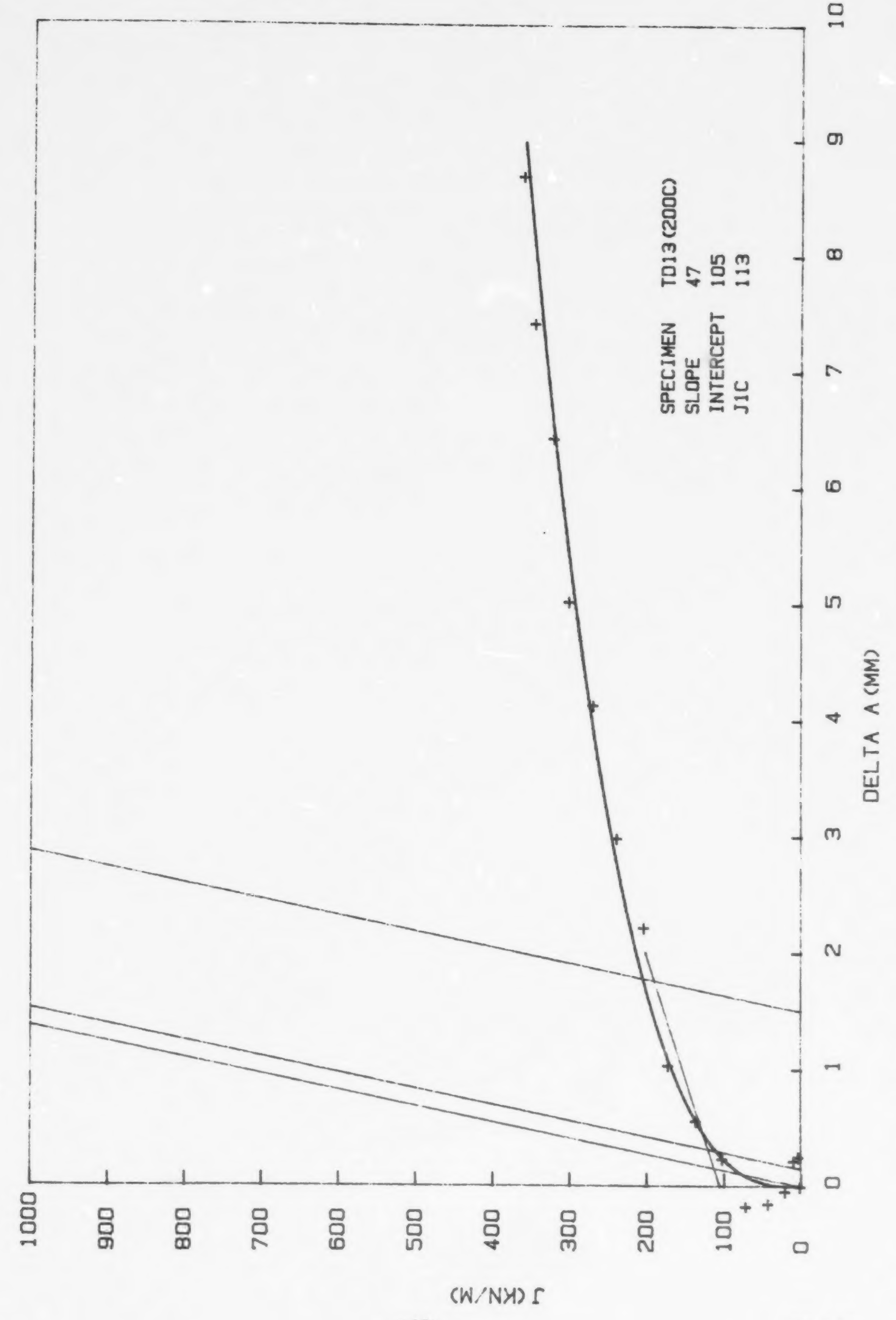
1st DATA POINT USED     11
LAST DATA POINT USED    31
CONSTANT(C1)            266.94
EXPONENT(C2)            .539
```

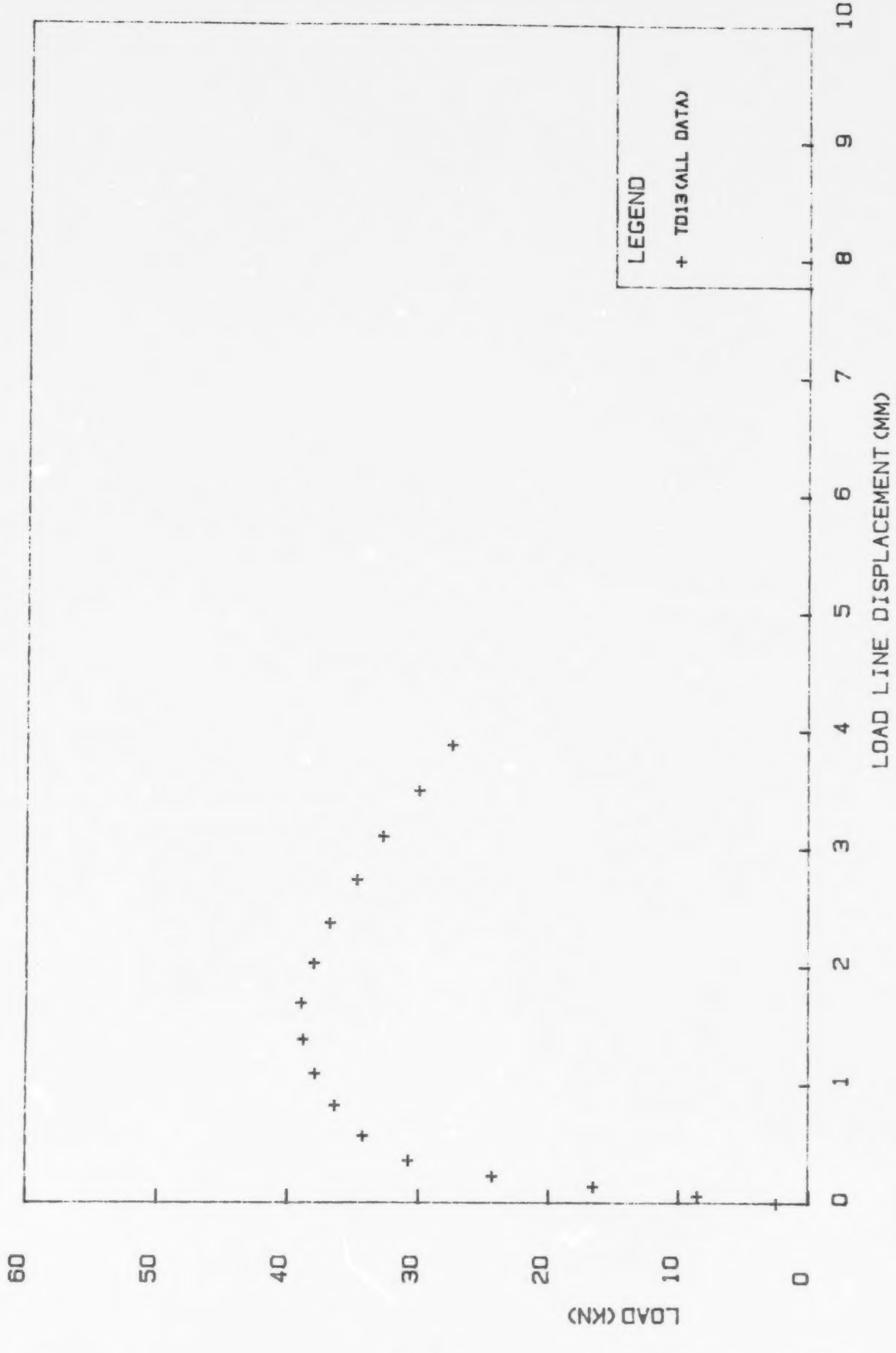
J85

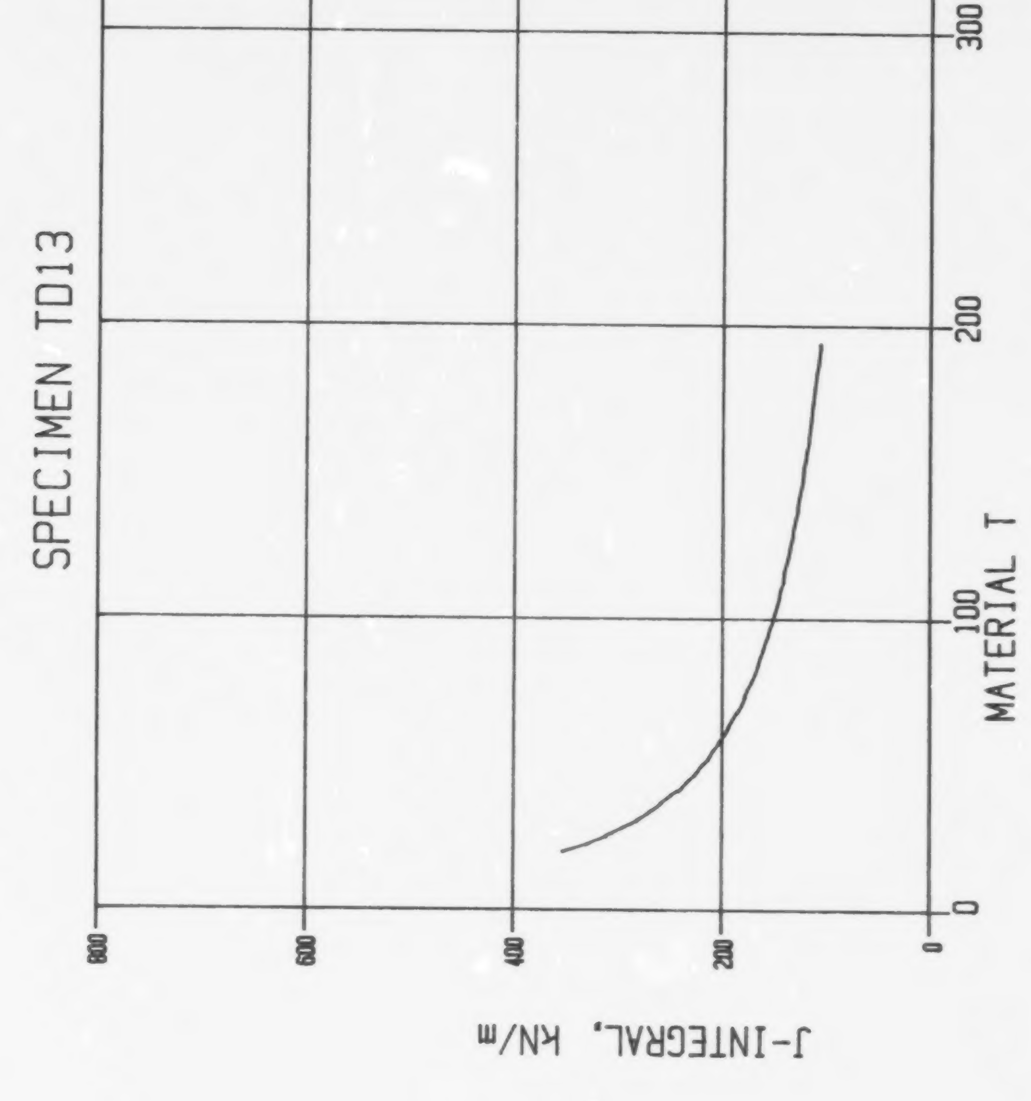
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
2.52	3.029	3.029	.253	.9957	1
4.94	2.999	2.999	-.047	.9996	2
8.92	2.994	2.995	-.092	.999	3
13.79	3.026	3.028	.236	.9992	4
22.69	3.005	3.007	.027	.9995	5
35.19	3.021	3.023	.193	.9985	6
50.85	2.987	2.991	-.133	.9974	7
67.62	2.985	2.989	-.146	.9992	8
83.47	3.011	3.016	.121	1	9
99.71	3.042	3.048	.438	.9984	10
119.65	3.029	3.036	.315	.9988	11
140.2	3.027	3.034	.303	.9997	12
158.45	3.038	3.046	.424	.999	13
181.04	3.029	3.039	.346	.9989	14
197.1	3.063	3.073	.692	.999	15
221.48	3.051	3.062	.575	.9992	16
241.85	3.059	3.071	.671	.9988	17
260.6	3.086	3.099	.945	.9985	18
278.25	3.111	3.125	1.207	.9994	19
301.1	3.117	3.131	1.27	.9991	20
319.97	3.137	3.152	1.482	.9982	21
342.17	3.148	3.164	1.597	.9988	22
360.19	3.175	3.191	1.871	.999	23
384.4	3.175	3.193	1.885	.9992	24
400.99	3.202	3.221	2.166	.9993	25
425.07	3.206	3.225	2.207	.9997	26
438.5	3.244	3.264	2.599	.9982	27
461.57	3.25	3.271	2.669	.999	28
473.79	3.287	3.308	3.037	.9996	29
499.22	3.286	3.308	3.043	.9999	30
515.46	3.311	3.334	3.298	.9997	31

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	J85
1	5.676	0	
2	8.545	.039	
3	12.085	.084	
4	15.137	.142	
5	18.066	.203	
6	20.386	.288	
7	21.667	.404	
8	22.705	.529	
9	23.376	.667	
10	24.109	.804	
11	24.658	.945	
12	25.208	1.086	
13	25.391	1.237	
14	25.818	1.378	
15	26.001	1.533	
16	26.367	1.678	
17	26.489	1.836	
18	26.489	1.987	
19	26.611	2.148	
20	26.489	2.301	
21	26.428	2.463	
22	26.306	2.621	
23	26.367	2.787	
24	26.062	2.952	
25	25.757	3.115	
26	25.635	3.279	
27	25.391	3.447	
28	24.963	3.619	
29	24.78	3.789	
30	24.231	3.956	
31	23.987	4.13	
32	23.682	4.305	

	J(KN/M)	T	W	J85
1	129.93	-1403.09	-255.02	
2	149.32	130.8	20.56	
3	169.74	-251.44	-34.91	
4	189.07	40.4	4.95	
5	209.29	-181.89	-20.25	
6	231.67	184.68	18.49	
7	251.22	59.43	5.41	
8	269.42	58.57	4.91	
9	289.67	313.97	24.39	
10	310.54	77.67	5.57	
11	331.07	167.35	11.18	
12	351.18	57.18	3.55	
13	372.29	1474.19	86.3	
14	392.69	51.37	2.81	
15	413.03	508.08	26.35	
16	431.78	29.84	1.45	
17	450.04	283.78	13.17	
18	467.68	28.9	1.27	
19	486.5	3379.49	142.14	
20	507.34	55.3	2.2	


SPECIMEN TD13 (200C)
SLOPE 47
INTERCEPT 105
J1C 113
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LEGEND
+ TD13 (ALL DATA)
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LOAD (KN)
0
10
20
30
40
50
60


SPECIMEN TD13
J-INTEGRAL, kN/m
800
600
400
200
0
MATERIAL T
0
100
200
300
400

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     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                    TD13
 MATERIAL TYPE                                      A106B
 MATERIAL CONDITION                                 PARENT
 TEST TEMPERATURE(DEG C)                            200
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          248.5
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        482
 CRACK PLANE ORIENTATION (PER ASTM E399)            L-C
 SPECIMEN THICKNESS B(CM)                           3.177
 PERCENT SIDE GROOVE                                20.333
 SPECIMEN WIDTH W(CM)                               6.365
 YOUNGS MODULUS AT TEST TEMP(Pa)                    1.8637E+11
 EFFECTIVE MODULUS(Pa)                              2.02762676E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           19.02
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.658

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                     3.742
 INITIAL A/W                                        .575
 AVERAGE CRACK EXTENSION 9PT(CM)                    .891
 DELTA A(CM) COMPLIANCE                             .869
 MAX DEVIATION OF SINGLE MEASUREMENT %              1.1

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                      7
 LAST POINT                       10
 JIC(KN/M)                        113
 CORRELATION COEFF                .9
 SLOPE M(MPa)                     47
 INTERCEPT B (KN/M)               105

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD         YES
 LIGAMENT>25JIC/EFFECTIVE YIELD   YES
 DJ/DA<EFFECTIVE YIELD            YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                           YES
 CRACK SIZE DA<0.15*DELTA A                         YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    462.22
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  335.75
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.707
 25*JQ/EF.Y.(CM)                                    .773

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED         7
 LAST DATA POINT USED        16
 CONSTANT(C1)                167.8
 EXPONENT(C2)                .3487
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            TD13(200C)

K          J-ELASTIC     J-PLASTIC     JEL+JPL     J(M)        J(TO.AREA)   CR. LN
(MPaRTM)    (KN/M)        (KN/M)        (KN/M)    (KN/M)          (KN/M)        (CM)

14.81      1.07          0              1.08       1.08         1.14     3.658   1
29.1       4.14          -.07           4.06       4.06         4.26     3.683   2
42.76      8.93          .91            9.84       9.84         10.32    3.68    3
53.2       13.82         7.59           21.41      21.4         22.25    3.653   4
58.87      16.92         26.84          43.76      43.71        44.83    3.643   5
62.45      19.05         53.6           72.64      72.56        73.84    3.641   6
66.61      21.66         81.24          102.9      103.88       103.92   3.681   7
69.53      23.6          113.37         136.97     139.24       137.8    3.713   8
71.75      25.13         147.54         172.67     177.62       173.13   3.761   9
75.24      27.64         176.53         204.17     217.91       203.73   3.879   10
76.51      28.58         211.08         239.66     260.46       238.51   3.956   11
77.95      29.67         240.89         270.56     304.27       268.47   4.071   12
78.2       29.86         272.64         302.5      348.16       299.59   4.16    13
79.53      30.88         291.81         322.69     390.3        319.1    4.3     14
78.82      30.34         317.17         347.51     432.56       343.17   4.399   15
76.78      28.78         333.96         362.75     473.13       357.89   4.527   16

H(M)            D(M)            POISSON'S RATIO
.02386          2.54E-03        .3
```
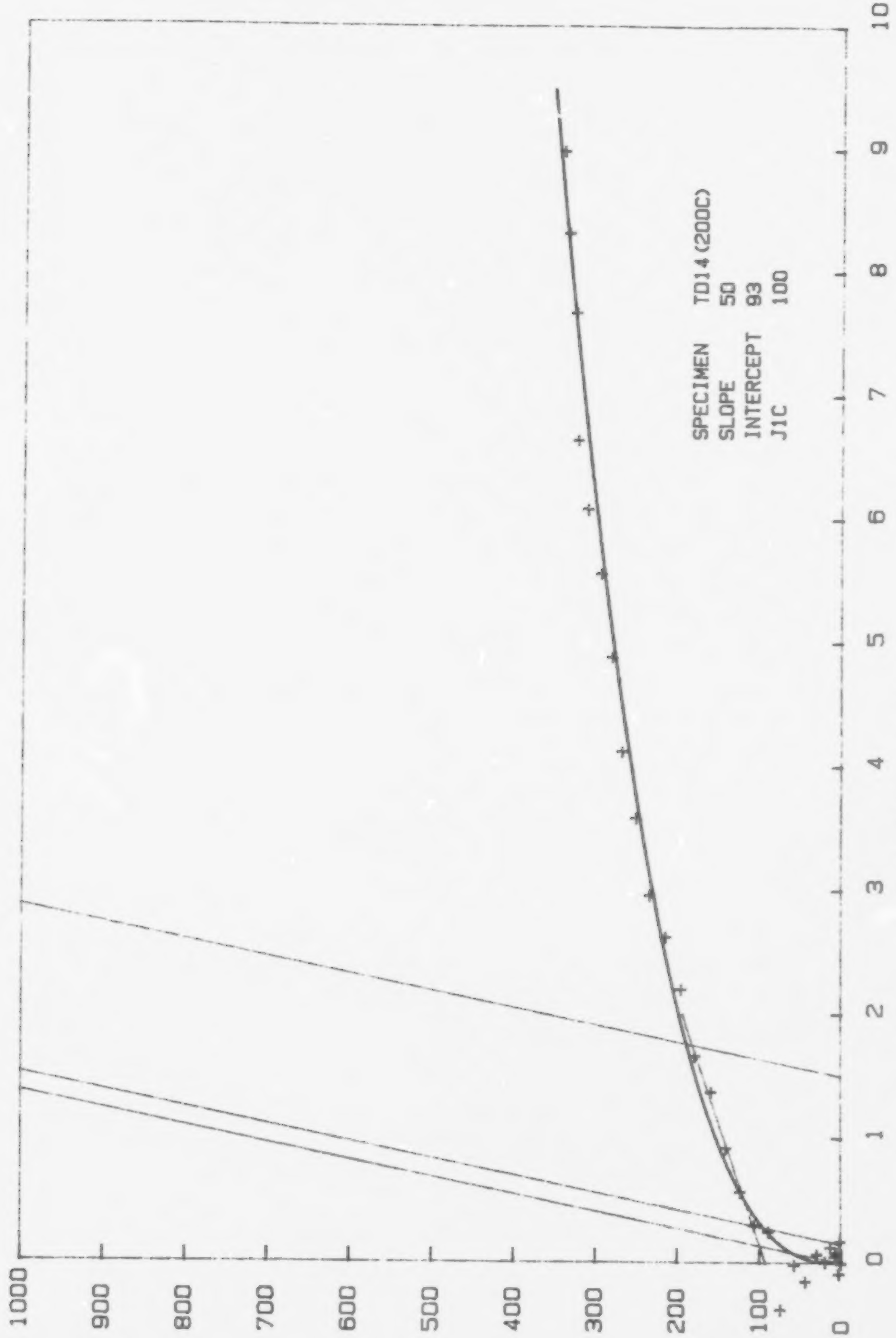
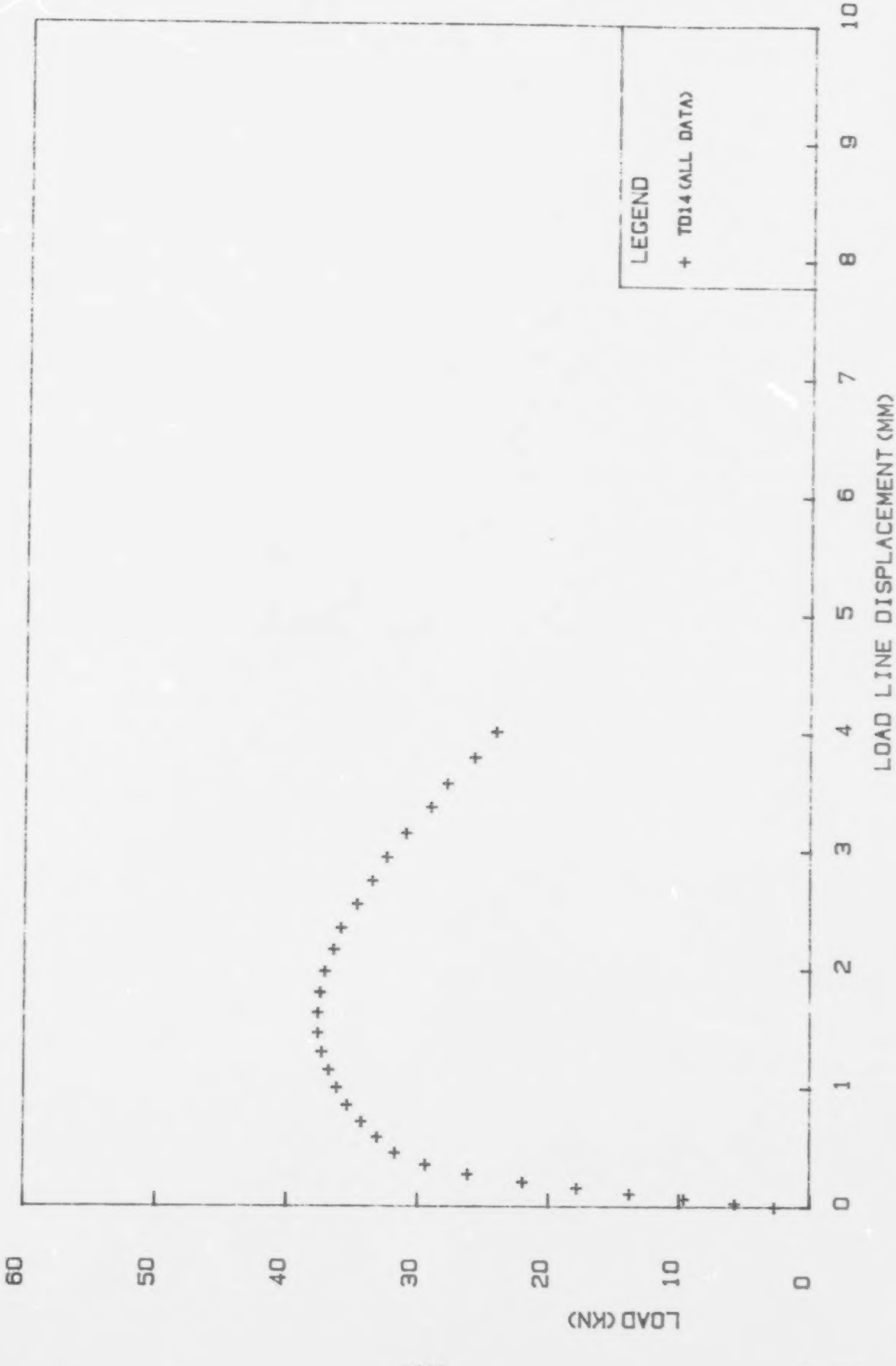

TD13

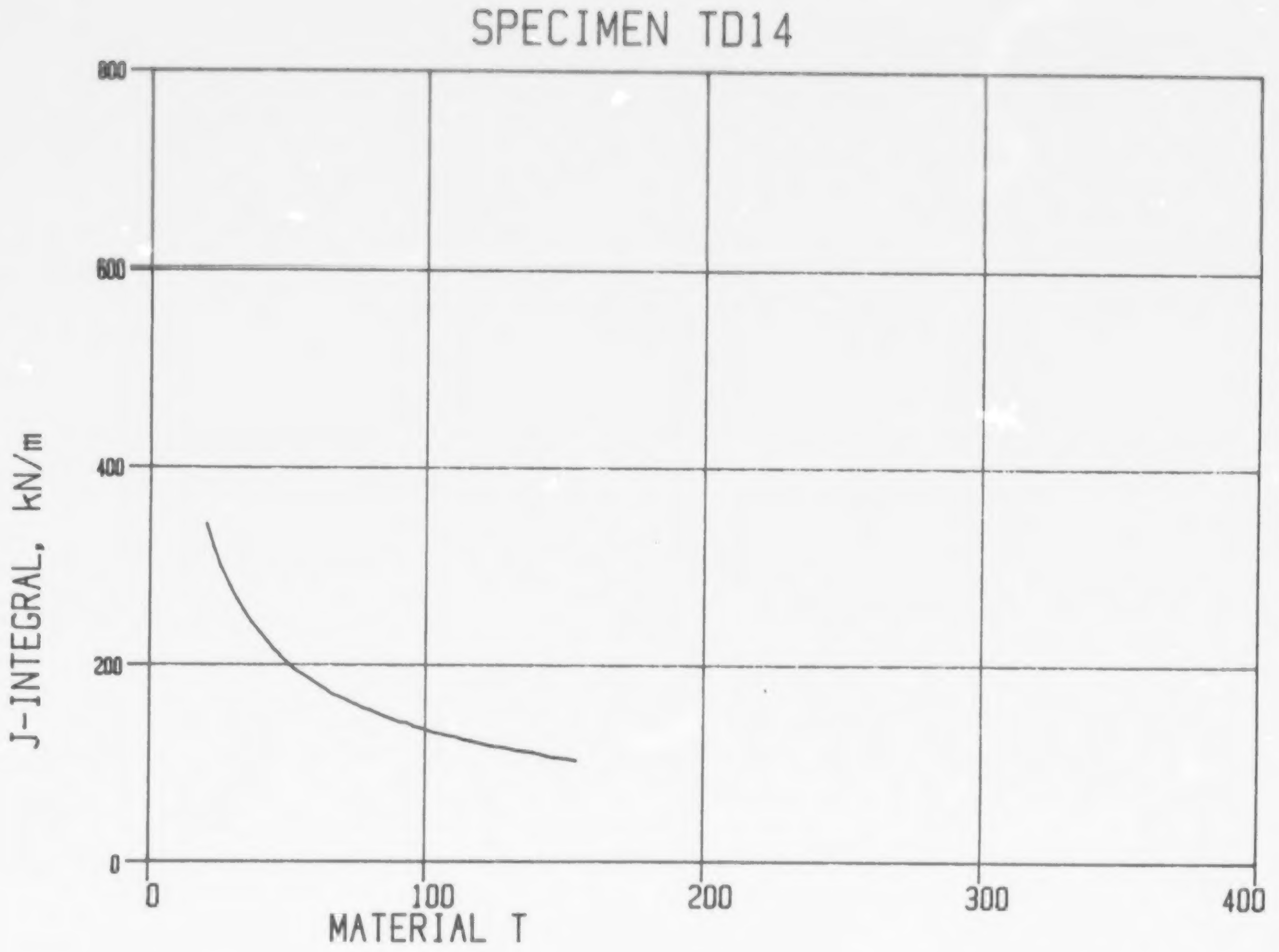
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.08	3.657	3.658	-4E-03	.9981	1
4.06	3.682	3.683	.251	.9992	2
9.84	3.678	3.68	.215	.9992	3
21.41	3.651	3.653	-.047	.9998	4
43.76	3.639	3.643	-.151	.9994	5
72.64	3.635	3.641	-.174	.9995	6
102.9	3.674	3.681	.23	.9996	7
136.97	3.705	3.713	.555	.9998	8
172.67	3.751	3.761	1.03	.9985	9
204.17	3.868	3.879	2.214	.9989	10
239.66	3.943	3.956	2.981	.9992	11
270.56	4.056	4.071	4.125	.999	12
302.5	4.145	4.16	5.018	.9996	13
322.69	4.284	4.3	6.424	.999	14
347.51	4.383	4.399	7.414	.9999	15
362.75	4.509	4.527	8.685	.9994	16

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	TD13
1	2.441	0	
2	8.545	.059	
3	16.541	.137	
4	[illegible].353	.227	
5	30.762	.356	
6	34.241	.569	
7	36.377	.823	
8	37.903	1.091	
9	38.818	1.379	
10	38.94	1.687	
11	37.964	2.024	
12	36.743	2.366	
13	34.668	2.734	
14	32.654	3.103	
15	29.907	3.491	
16	27.405	3.877	
17	23.987	4.287	

	J(KN/M)	T	W	TD13
1	119.94	146.66	23.21	
2	154.82	104.87	12.63	
3	188.42	37.18	3.51	
4	221.91	64.62	5.02	
5	255.11	37.74	2.43	
6	286.53	49.94	2.75	
7	312.59	20.07	.95	
8	335.1	35.02	1.47	
9	355.13	16.74	.62	


SPECIMEN TD14(200C)
SLOPE 50
INTERCEPT 93
J1C 100
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000


LEGEND
+ TD14 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN TD14

TD14(200C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
10.06	.49	-.01	.48	.48	.51	3.679	1
17.08	1.42	-.02	1.4	1.4	1.47	3.696	2
24.06	2.83	.21	3.04	3.04	3.2	3.67	3
31.39	4.81	.46	5.27	5.27	5.53	3.687	4
38.64	7.29	1.02	8.31	8.31	8.71	3.684	5
46.25	10.44	2.82	13.27	13.27	13.83	3.691	6
51.61	13.01	7.32	20.32	20.31	21.05	3.68	7
55.87	15.24	14.84	30.08	30.09	30.92	3.686	8
57.5	16.15	28.23	44.38	44.23	45.33	3.664	9
60.09	17.63	40.42	58.06	58.09	59.05	3.677	10
60.73	18.01	57	75.01	74.33	76.15	3.641	11
64.39	20.24	68.85	89.09	90.15	90.16	3.704	12
65.67	21.06	85.56	106.62	107.85	107.71	3.709	13
67.71	22.39	101.03	123.42	125.78	124.49	3.736	14
69.72	23.73	117.25	140.98	145.11	141.99	3.771	15
71.67	25.08	133.55	158.63	165.45	159.54	3.816	16
72.6	25.74	152.53	178.26	187.04	179.08	3.845	17
74.39	27.02	168.32	195.34	208.39	196.03	3.899	18
75.06	27.51	187.11	214.62	231.39	215.14	3.941	19
75.58	27.89	206.21	234.1	254.24	234.48	3.975	20
76.12	28.29	222.87	251.16	278.21	251.3	4.037	21
76.35	28.46	239.74	268.2	301.82	268.12	4.091	22
77.96	29.68	250.8	280.48	324.36	280.25	4.167	23
78.24	29.89	264.3	294.18	347.82	293.73	4.235	24
76.41	28.51	282.67	311.18	372.94	310.38	4.287	25
76.47	28.55	294.98	323.53	394.8	322.56	4.343	26
76.94	28.9	297.67	326.57	416.52	325.63	4.446	27
76.06	28.25	308.06	336.32	438.56	335.17	4.51	28
76.17	28.33	314.29	342.62	458.43	341.4	4.577	29

H(M)	D(M)	POISSON'S RATIO
.02383	2.54E-03	.3

DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	TD14
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	200
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	248.5
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	482
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	3.174
PERCENT SIDE GROOVE	19.88
SPECIMEN WIDTH W(CM)	6.363
YOUNGS MODULUS AT TEST TEMP(Pa)	1.8637E+11
EFFECTIVE MODULUS(Pa)	2.08093956E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	19.28
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.679

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.791
INITIAL A/W	.578
AVERAGE CRACK EXTENSION 9PT(CM)	.898
DELTA A(CM) COMPLIANCE	.898
MAX DEVIATION OF SINGLE MEASUREMENT %	1.1

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	13
LAST POINT	17
JIC(KN/M)	100
CORRELATION COEFF	.99
SLOPE M(MPa)	50
INTERCEPT B (KN/M)	93

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	NO
CRACK SIZE DA<0.15*DELTA A	NO
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	464.42
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	1162.04
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.684
25*JQ/EF.Y.(CM)	.684

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

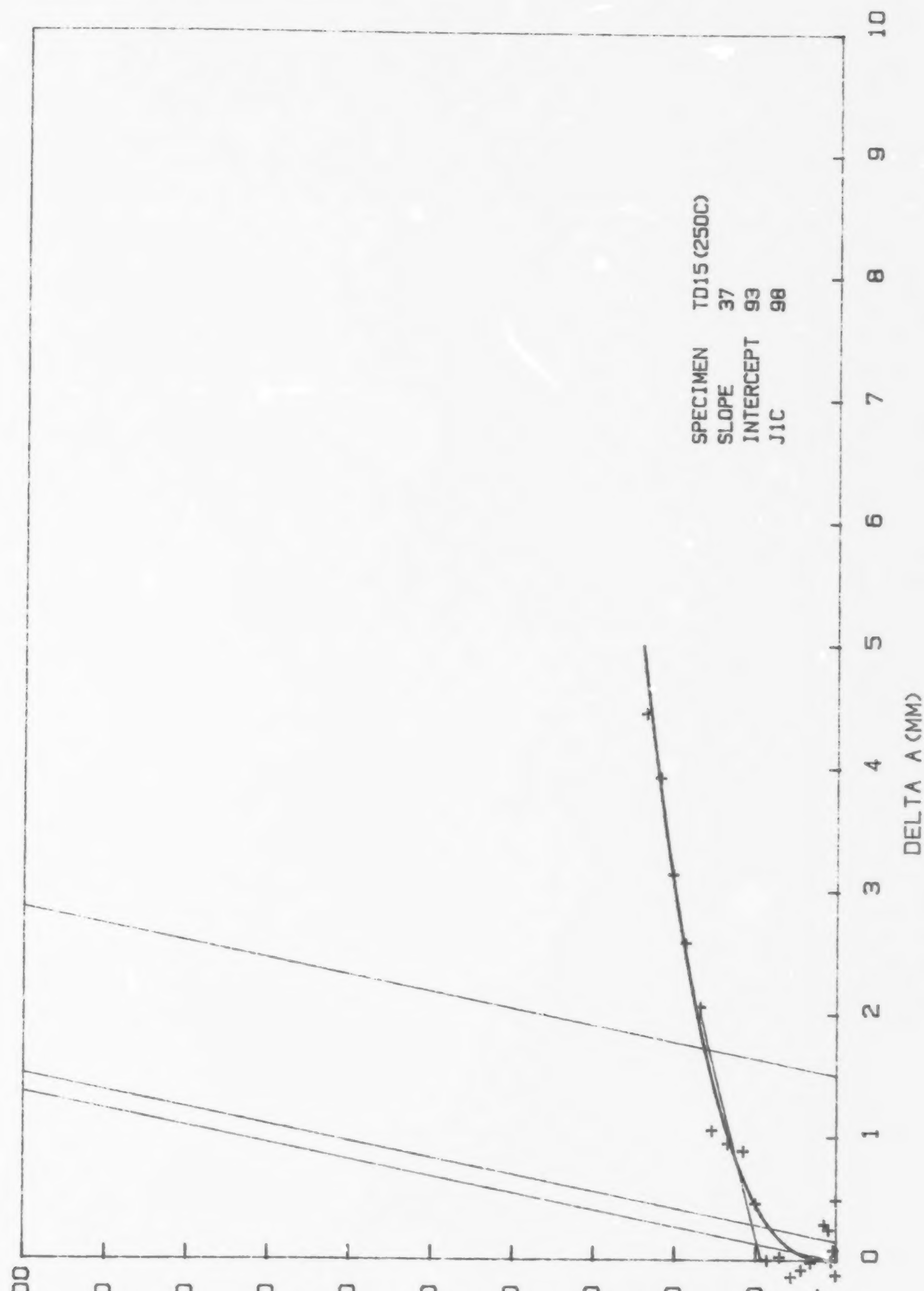
1st DATA POINT USED	13
LAST DATA POINT USED	29
CONSTANT(C1)	152.79
EXPONENT(C2)	.3752

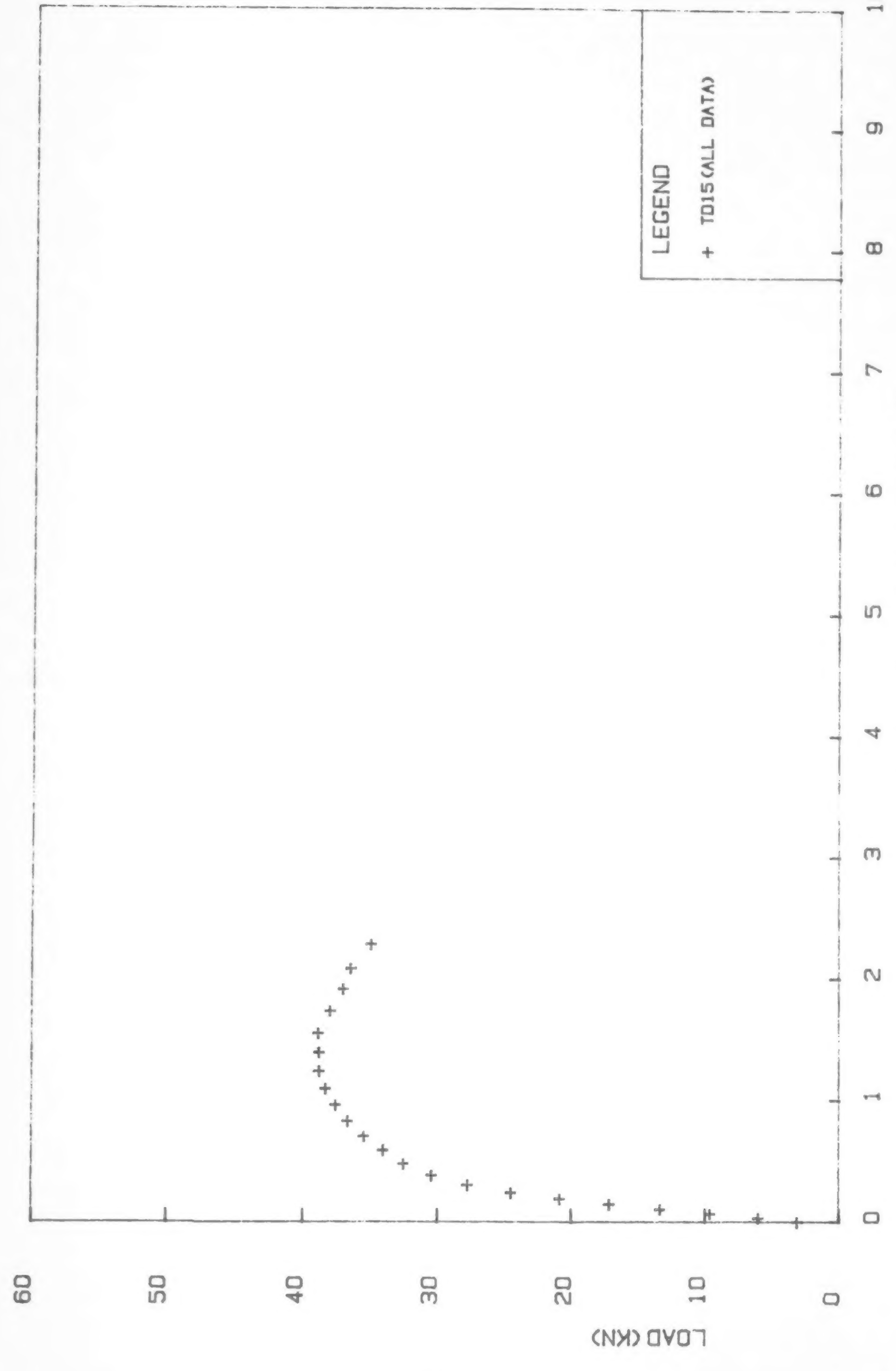
TD14

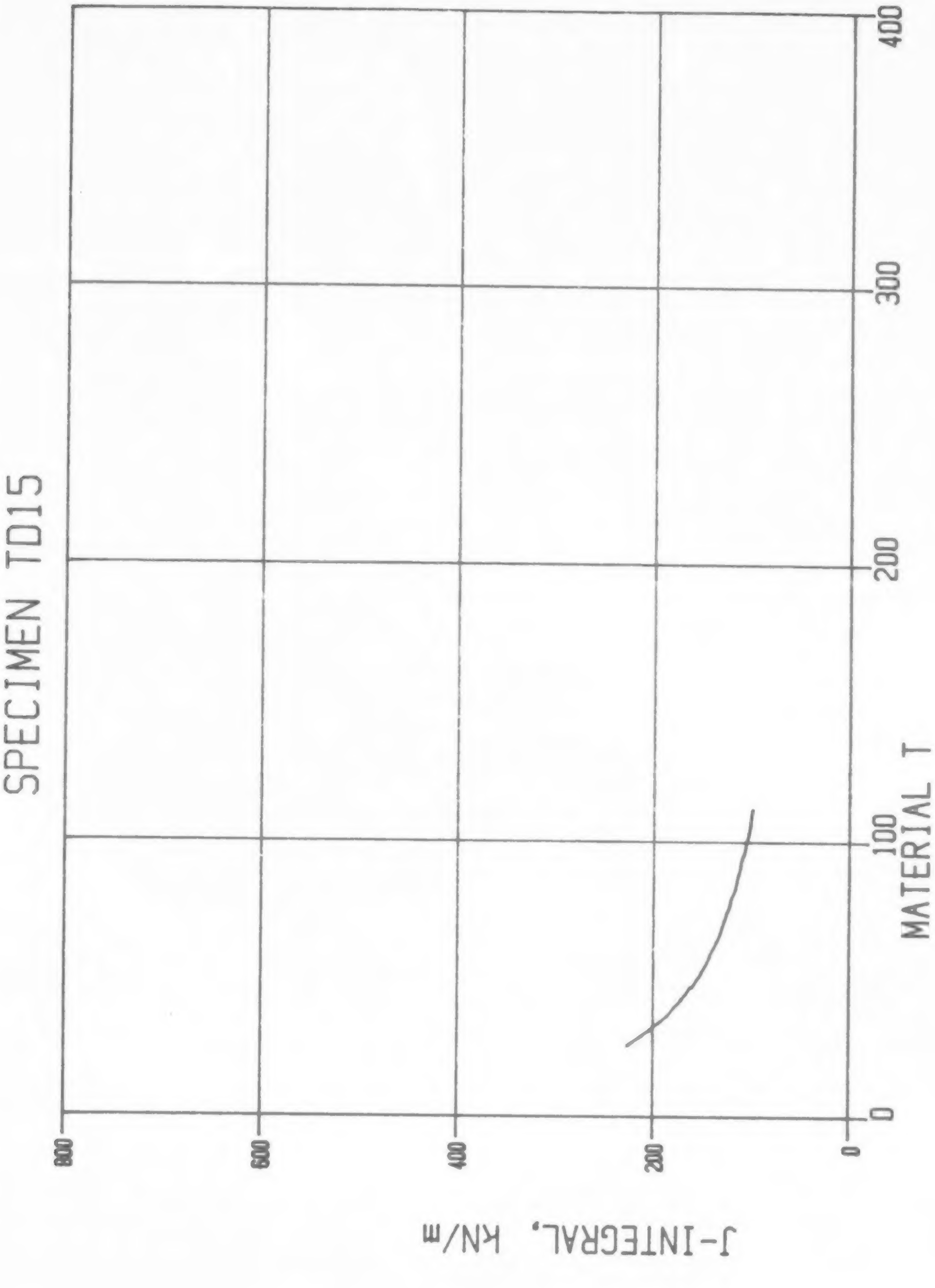
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.48	3.678	3.679	-4E-03	.9987	1
1.4	3.696	3.696	.171	.9989	2
3.04	3.67	3.67	-.088	.9996	3
5.27	3.686	3.687	.076	.9995	4
8.31	3.683	3.684	.049	.9998	5
13.27	3.69	3.691	.125	.9989	6
20.32	3.678	3.68	9E-03	.9991	7
30.08	3.683	3.686	.067	.9993	8
44.38	3.66	3.664	-.15	.9995	9
58.06	3.673	3.677	-.016	.9998	10
75.01	3.636	3.641	-.378	.9993	11
89.09	3.698	3.704	.248	.9993	12
106.62	3.702	3.709	.299	.9996	13
123.42	3.728	3.736	.566	.9994	14
140.98	3.762	3.771	.917	.9991	15
158.63	3.807	3.816	1.37	.9992	16
178.26	3.834	3.845	1.657	.9994	17
195.34	3.888	3.899	2.198	.9995	18
214.62	3.929	3.941	2.62	.9995	19
234.1	3.962	3.975	2.957	.9998	20
251.16	4.024	4.037	3.581	.9996	21
268.2	4.077	4.091	4.117	.999	22
280.48	4.153	4.167	4.882	.9996	23
294.18	4.22	4.235	5.559	.9996	24
311.18	4.272	4.287	6.08	.9992	25
323.53	4.327	4.343	6.64	.9996	26
326.57	4.43	4.446	7.671	.9991	27
336.32	4.494	4.51	8.315	.9994	28
342.62	4.561	4.577	8.983	.9997	29

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	TD14
1	2.675	0	
2	5.737	.029	
3	9.644	.068	
4	13.794	.112	
5	17.822	.158	
6	21.973	.207	
7	26.184	.273	
8	29.419	.351	
9	31.738	.451	
10	33.081	.583	
11	34.302	.712	
12	35.4	.851	
13	36.194	.998	
14	36.804	1.147	
15	37.354	1.298	
16	37.659	1.459	
17	37.659	1.628	
18	37.476	1.801	
19	37.109	1.977	
20	36.438	2.162	
21	35.889	2.346	
22	34.668	2.546	
23	33.508	2.743	
24	32.41	2.941	
25	30.945	3.146	
26	29.053	3.366	
27	27.832	3.566	
28	25.757	3.788	
29	24.109	4.006	
30	22.766	4.211	
31	20.996	4.43	

	J(KN/M)	T	W	TD14
1	97.86	476.74	92.56	
2	115.02	88.2	14.42	
3	132.2	69.8	9.8	
4	149.81	54.41	6.62	
5	168.45	95.64	10.23	
6	186.8	44.07	4.16	
7	204.98	63.89	5.4	
8	224.36	80.66	6.15	
9	242.63	38.24	2.62	
10	259.68	44.35	2.78	
11	274.34	22.42	1.28	
12	287.33	28.31	1.5	
13	302.68	45.57	2.24	
14	317.36	30.8	1.4	
15	325.05	4.12	.17	
16	331.44	21.13	.85	
17	339.47	13.19	.5	


SPECIMEN TD15(250C)
SLOPE 37
INTERCEPT 93
J1C 98
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10
+


LEGEND
+ TD15 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN TD15
MATERIAL T
J-INTEGRAL, kN/m
0
100
200
300
400
0
200
400
600
800

```
     DATA SHEET-J1-R CURVE TEST

               TEST SPECIMEN DATA

  SPECIMEN NUMBER                                   TD15
  MATERIAL TYPE                                     A106B
  MATERIAL CONDITION                                PARENT
  TEST TEMPERATURE(DEG C)                           250
  MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)         228
  MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)       510.8
  CRACK PLANE ORIENTATION (PER ASTM E399)           L-C
  SPECIMEN THICKNESS B(CM)                          3.175
  PERCENT SIDE GROOVE                               19.653
  SPECIMEN WIDTH W(CM)                              6.36
  YOUNGS MODULUS AT TEST TEMP(Pa)                   1.82776E+11
  EFFECTIVE MODULUS(Pa)                             1.96327286E+11

               FATIGUE PRE-CRACKING DATA

  MAX LOAD IN PRE-CRACKING(LAST 50%) KN             12.5
  MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM          18.54
  INITIAL CRACK LENGTH-COMPLIANCE(CM)               3.609

               CRACK LENGTH MEASUREMENT

  AVERAGE FATIGUE LENGTH 9PT(CM)                    3.728
  INITIAL A/W                                       .567
  AVERAGE CRACK EXTENSION 9PT(CM)                   .468
  DELTA A(CM) COMPLIANCE                            .444
  MAX DEVIATION OF SINGLE MEASUREMENT %             .74

               ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

  FIRST POINT                         14
  LAST POINT                          19
  JIC(KN/M)                           98
  CORRELATION COEFF                   .86
  SLOPE M(MPa)                        37
  INTERCEPT B (KN/M)                  93

               VALIDITY(JIC)

  BN>25JIC/EFFECTIVE YIELD            YES
  LIGAMENT>25JIC/EFFECTIVE YIELD      YES
  DJ/DA<EFFECTIVE YIELD               YES

               QUALIFICATION OF R-CURVE DATA

  CRACK EXTENSION VALIDITY                          YES
  CRACK SIZE DA<0.15*DELTA A                        YES
  J(MAX)ALLOWED(BN*EF.Y./20) KN/M                   471.17
  OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                 426.05
  DELTA A(MAX) ALLOWED(MM)(0.1*b0)                  2.751
  25*JQ/EF.Y.(CM)                                   .663

               CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

  1st DATA POINT USED           14
  LAST DATA POINT USED          22
  CONSTANT(C1)                  133.85
  EXPONENT(C2)                  .365
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          TD15(250C)

K          J-ELASTIC      J-PLASTIC     JEL+JPL     J(M)        J(TO.AREA)   CR. LN
(MPaRTM)   (KN/M)         (KN/M)        (KN/M)     (KN/M)         (KN/M)        (CM)

10.46      .54            .03           .58         .58          .58       3.658  1
16.13      1.3            .13           1.43        1.42         1.49      3.597  2
21.29      2.26           .64           2.89        2.89         3.03      3.509  3
29.01      4.19           .36           4.55        4.58         4.72      3.617  4
35.13      6.15           .99           7.14        7.16         7.41      3.608  5
41.9       8.74           1.67          10.41       10.44        10.79     3.634  6
47.54      11.25          4.3           15.56       15.6         16.07     3.638  7
50.51      12.7           10.87         23.57       23.5         24.22     3.582  8
54.72      14.91          17.62         32.52       32.58        33.24     3.607  9
57.09      16.23          28.2          44.43       44.43        45.23     3.601  10
59.26      17.48          39.65         57.13       57.06        58        3.596  11
61.86      19.05          51.66         70.71       70.95        71.62     3.612  12
63.31      19.95          66.36         86.32       86.49        87.28     3.609  13
66.25      21.85          78.36         100.21      101.85       101.16    3.655  14
68.78      23.55          92.1          115.66      118.93       116.56    3.698  15
69.03      23.72          111.04        134.76      138.32       135.66    3.704  16
69.58      24.11          130.01        154.12      158.27       154.99    3.715  17
72.18      25.94          142.63        168.57      179.21       169.23    3.815  18
72.63      26.26          160.42        186.68      201.11       187.15    3.867  19
74.14      27.37          175.12        202.49      221.57       202.84    3.923  20
74.82      27.87          190.34        218.21      244.6        218.29    4.001  21
74.11      27.34          208.29        235.63      267.4        235.46    4.053  22

H(M)           D(M)           POISSON'S RATIO
.02384         2.54E-03       .3
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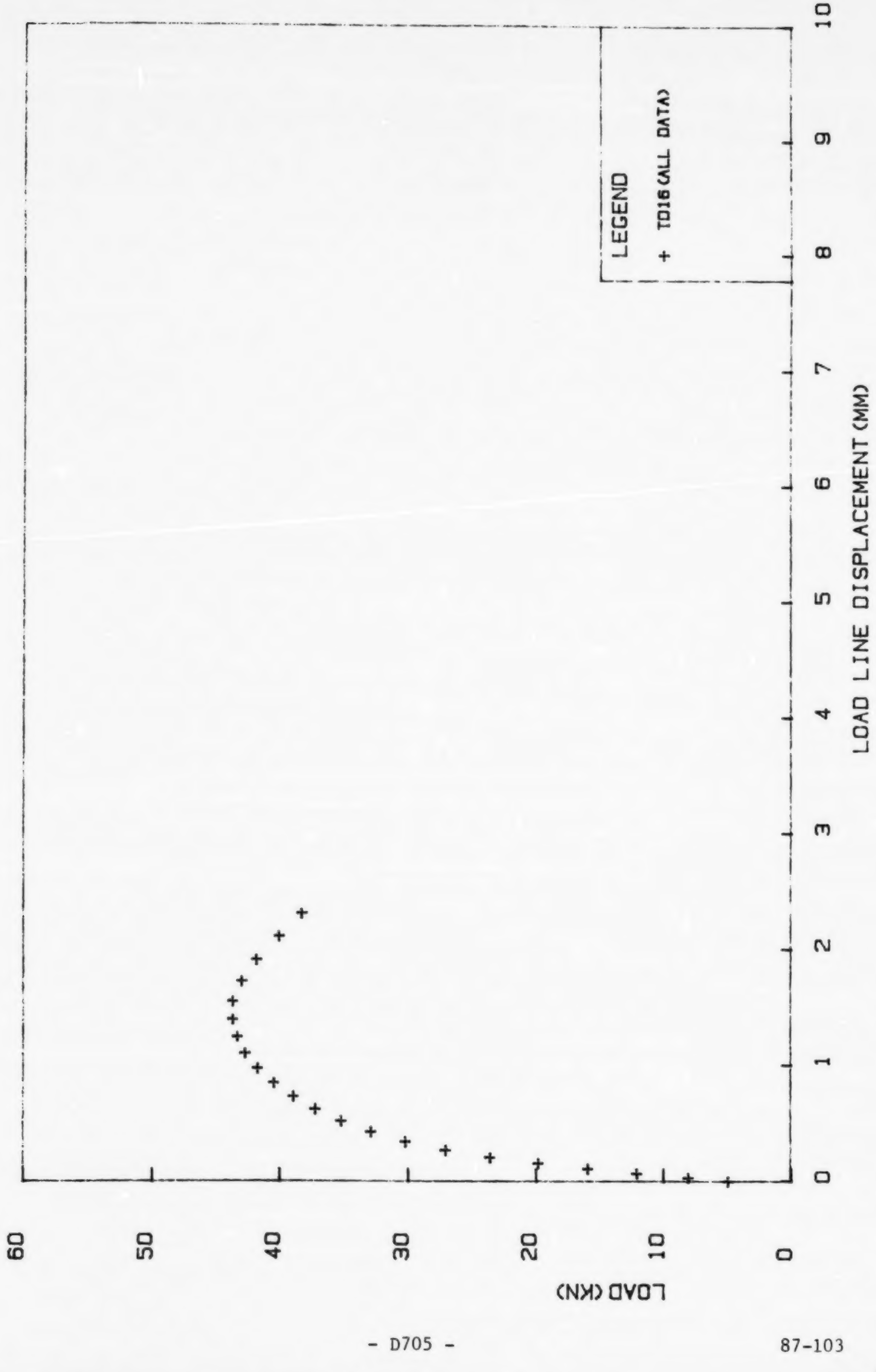
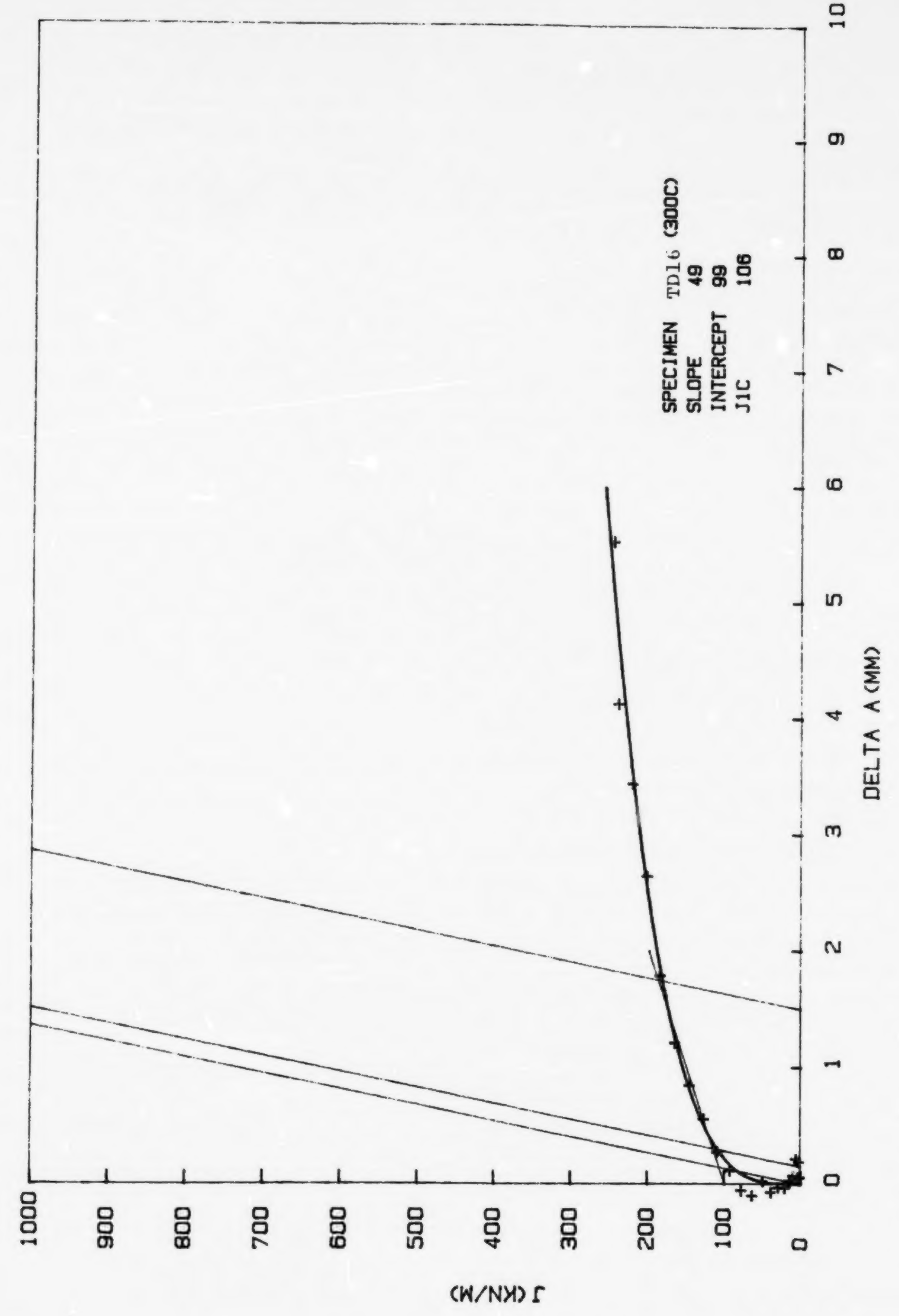
TD15

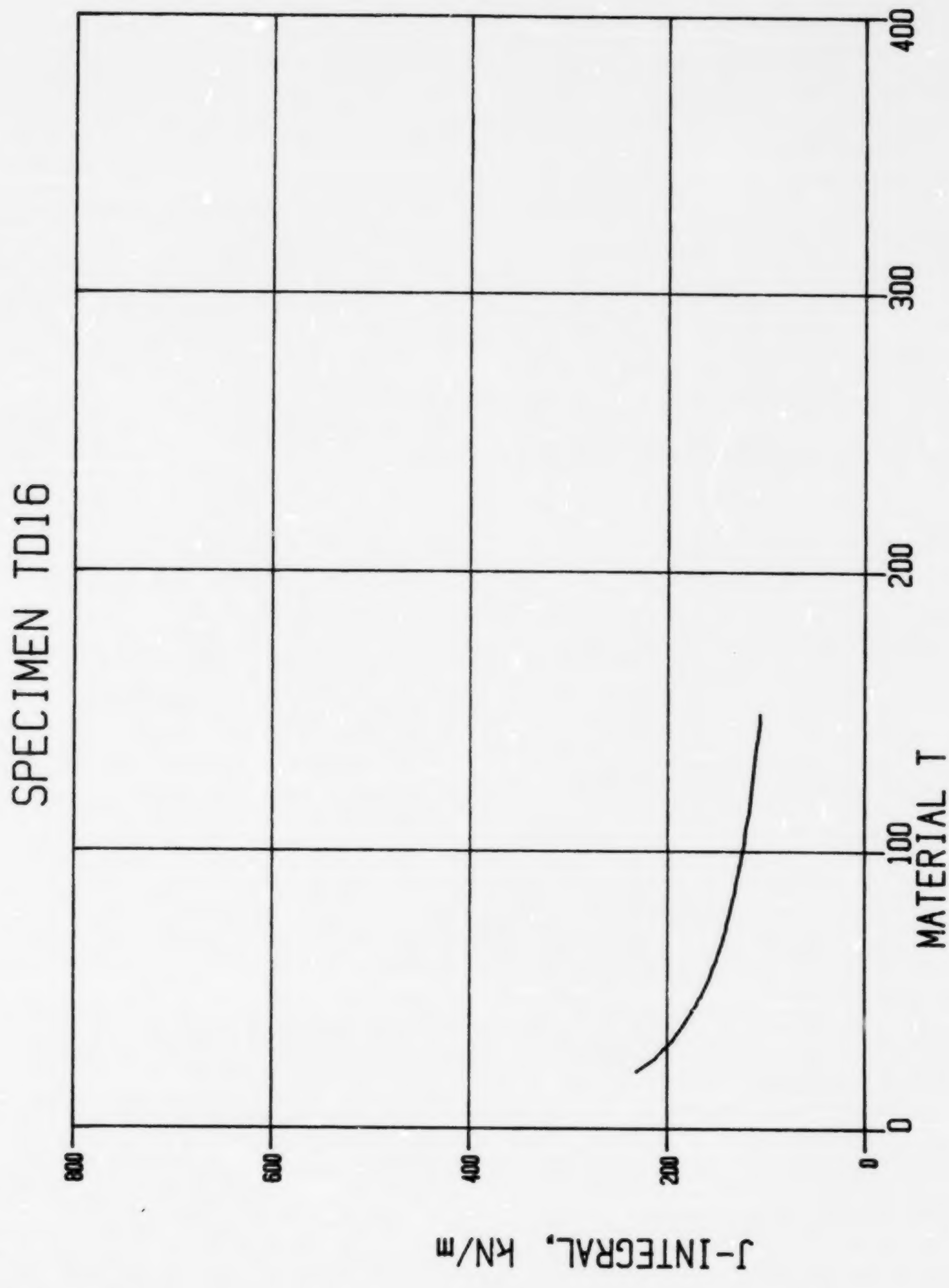
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.58	3.658	3.658	.49	.9973	1
1.43	3.597	3.597	-.118	.9943	2
2.89	3.508	3.509	-1	.9917	3
4.55	3.616	3.617	.084	.9963	4
7.14	3.607	3.608	-5E-03	.9991	5
10.41	3.632	3.634	.249	.999	6
15.56	3.636	3.638	.291	.9965	7
23.57	3.58	3.582	-.27	.9922	8
32.52	3.604	3.607	-.017	.9987	9
44.43	3.598	3.601	-.078	.9995	10
57.13	3.591	3.596	-.134	.9997	11
70.71	3.607	3.612	.028	.9995	12
86.32	3.603	3.609	1E-03	.999	13
100.21	3.648	3.655	.46	.9982	14
115.66	3.69	3.698	.887	.9982	15
134.76	3.695	3.704	.948	.999	16
154.12	3.705	3.715	1.057	.998	17
168.57	3.805	3.815	2.059	.9982	18
186.68	3.856	3.867	2.578	.9992	19
202.49	3.911	3.923	3.135	.9994	20
218.21	3.989	4.001	3.923	.9995	21
235.63	4.04	4.053	4.443	.999	22

```
            LOAD(KN)        LOAD LINE DISPLACEMENT(MM)      TD15
 1           3.113           0
 2           6.042           .032
 3           9.644           .066
 4           13.367          .105
 5           17.151          .146
 6           20.874          .19
 7           24.536          .239
 8           27.771          .303
 9           30.457          .383
 10          32.532          .479
 11          34.058          .591
 12          35.461          .706
 13          36.682          .83
 14          37.598          .962
 15          38.33           1.096
 16          38.818          1.24
 17          38.818          1.394
 18          38.879          1.553
 19          37.964          1.736
 20          36.987          1.917
 21          36.438          2.087
 22          34.912          2.285
 23          33.386          2.478
```

	J(KN/M)	T	W	TD15
1	93.27	40.56	8.78	
2	107.94	48.49	8.93	
3	125.21	420	66.52	
4	144.44	236.62	32.35	
5	161.34	19.32	2.28	
6	177.63	46.81	4.91	
7	194.59	37.97	3.55	
8	210.35	26.71	2.24	
9	226.92	44.92	3.41	


LEGEND
+ TD16 (ALL DATA)
LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN TD16 (300C)
SLOPE 49
INTERCEPT 99
J1C 106
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


SPECIMEN TD16
J-INTEGRAL, kN/m
0
200
400
600
800
MATERIAL T
0
100
200
300
400

```
      DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

    SPECIMEN NUMBER                                    TD16
    MATERIAL TYPE                                      A106B
    MATERIAL CONDITION                                 PARENT
    TEST TEMPERATURE(DEG C)                            300
    MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)          223
    MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)        513.75
    CRACK PLANE ORIENTATION (PER ASTM E399)            C-L
    SPECIMEN THICKNESS B(CM)                           3.174
    PERCENT SIDE GROOVE                                19.596
    SPECIMEN WIDTH W(CM)                               6.36600001
    YOUNGS MODULUS AT TEST TEMP(Pa)                    1.7854E+11
    EFFECTIVE MODULUS(Pa)                              1.99284863E+11

                 FATIGUE PRE-CRACKING DATA

    MAX LOAD IN PRE-CRACKING(LAST 50%) KN              12.5
    MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM           18.22
    INITIAL CRACK LENGTH-COMPLIANCE(CM)                3.581

                 CRACK LENGTH MEASUREMENT

    AVERAGE FATIGUE LENGTH 9PT(CM)                     3.702
    INITIAL A/W                                        .563
    AVERAGE CRACK EXTENSION 9PT(CM)                    .572
    DELTA A(CM) COMPLIANCE                             .553
    MAX DEVIATION OF SINGLE MEASUREMENT %              .69

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

    FIRST POINT                     14
    LAST POINT                      18
    JIC(KN/M)                       106
    CORRELATION COEFF               .98
    SLOPE M(MPa)                    49
    INTERCEPT B (KN/M)              99

                 VALIDITY(JIC)

    BN>25JIC/EFFECTIVE YIELD        YES
    LIGAMENT>25JIC/EFFECTIVE YIELD  YES
    DJ/DA<EFFECTIVE YIELD           YES

                 QUALIFICATION OF R-CURVE DATA

    CRACK EXTENSION VALIDITY                           NO
    CRACK SIZE DA<0.15*DELTA A                         YES
    J(MAX)ALLOWED(BN*EF.Y./20) KN/M                    470.05
    OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                  411.15
    DELTA A(MAX) ALLOWED(MM)(0.1*b0)                   2.785
    25*JQ/EF.Y.(CM)                                    .719

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

    1st DATA POINT USED        14
    LAST DATA POINT USED       22
    CONSTANT(C1)               154.05
    EXPONENT(C2)               .2854
```

TD16(300C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR.	LN (CM)
13.36	.91	.01	.92	.92	.96	3.587	1
20.2	2.08	-.03	2.05	2.05	2.14	3.6	2
26.43	3.56	.22	3.78	3.78	3.95	3.587	3
33.2	5.62	.63	6.25	6.25	6.5	3.603	4
39.21	7.84	1.88	9.72	9.72	10.09	3.588	5
44.88	10.26	4.23	14.49	14.49	14.99	3.584	6
49.87	12.67	8.24	20.91	20.89	21.53	3.578	7
54.31	15.03	13.97	29	28.98	29.73	3.578	8
58.01	17.15	21.72	38.87	38.82	39.7	3.574	9
61.65	19.37	30.79	50.16	50.22	51.08	3.584	10
64.03	20.9	42.69	63.59	63.46	64.6	3.571	11
66.71	22.68	55.05	77.73	77.69	78.82	3.576	12
69.48	24.61	68.01	92.61	93.02	93.76	3.593	13
71.75	26.24	83	109.24	110.17	110.42	3.609	14
73.94	27.87	98.89	126.76	128.82	127.94	3.637	15
75.81	29.3	115.92	145.22	148.66	146.39	3.666	16
77.45	30.57	133.52	164.09	169.61	165.21	3.702	17
78.8	31.65	151.85	183.5	192.84	184.47	3.76	18
80.79	33.27	167.72	200.99	216.87	201.75	3.846	19
81.37	33.75	186.39	220.13	242.89	220.59	3.925	20
81.36	33.74	205.35	239.08	268.62	239.24	3.994	21
85.29	37.07	207.81	244.89	289.96	245.13	4.134	22

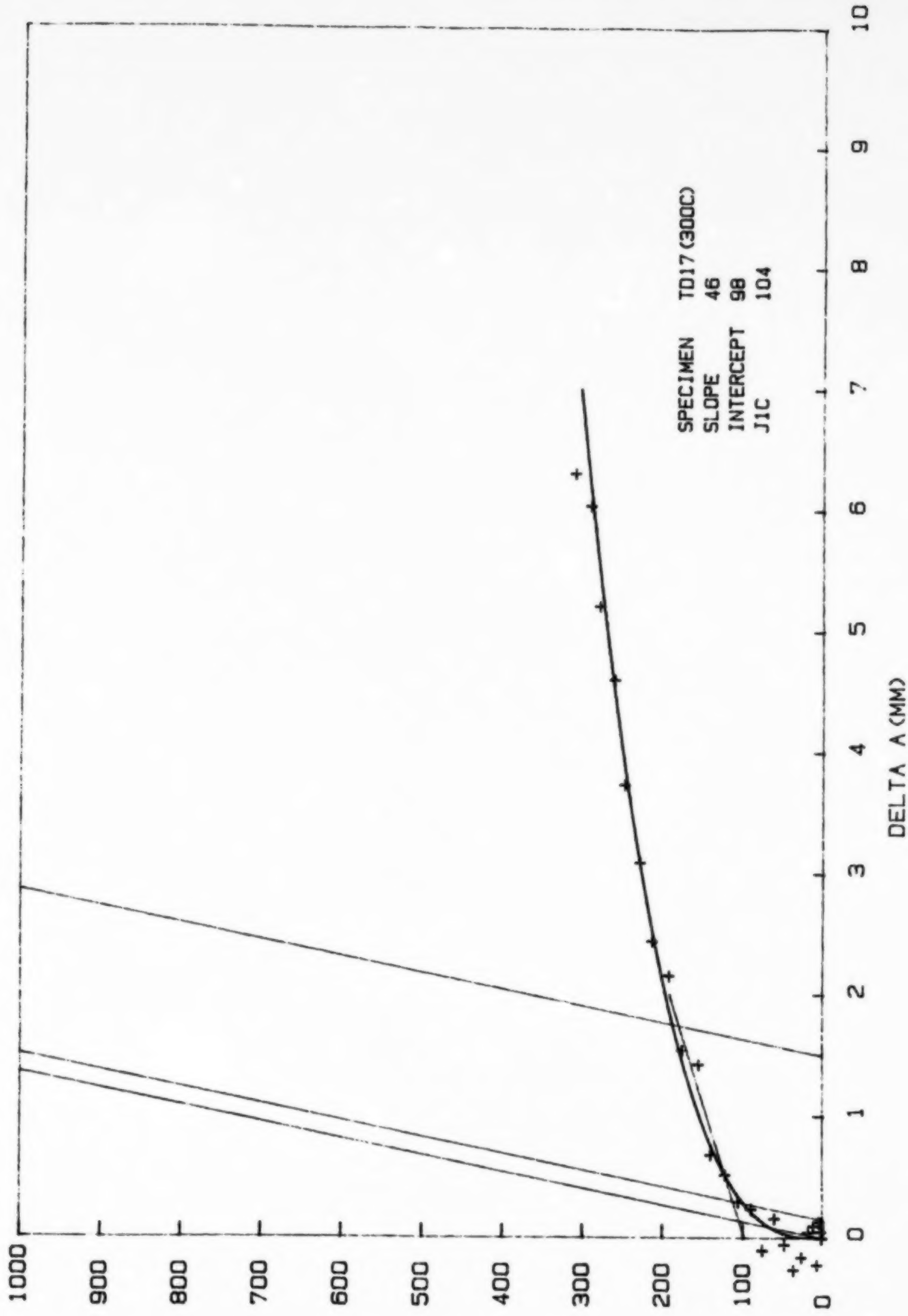
H(M)	D(M)	POISSON'S RATIO
.02378	2.54E-03	.3

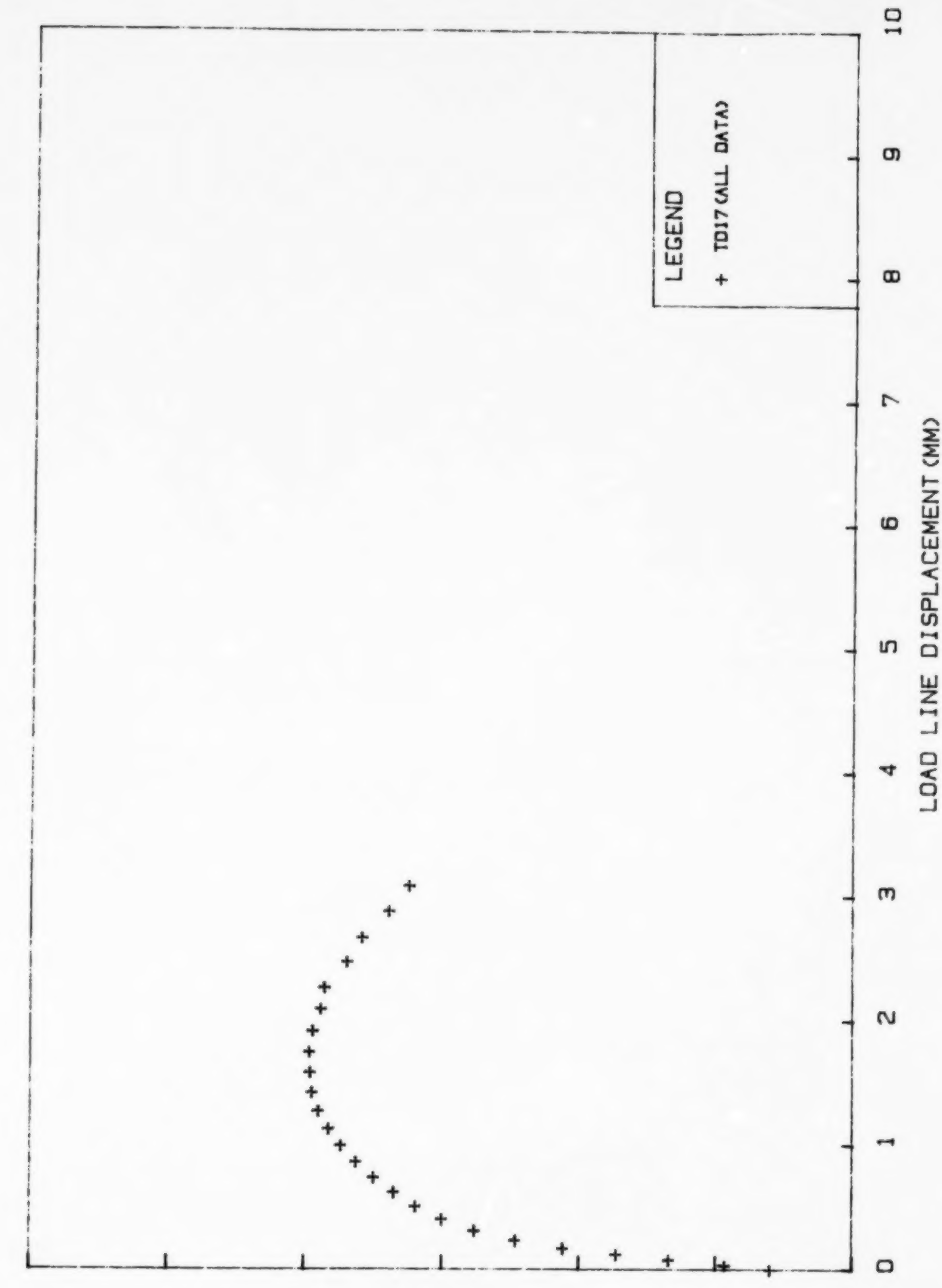
TD16

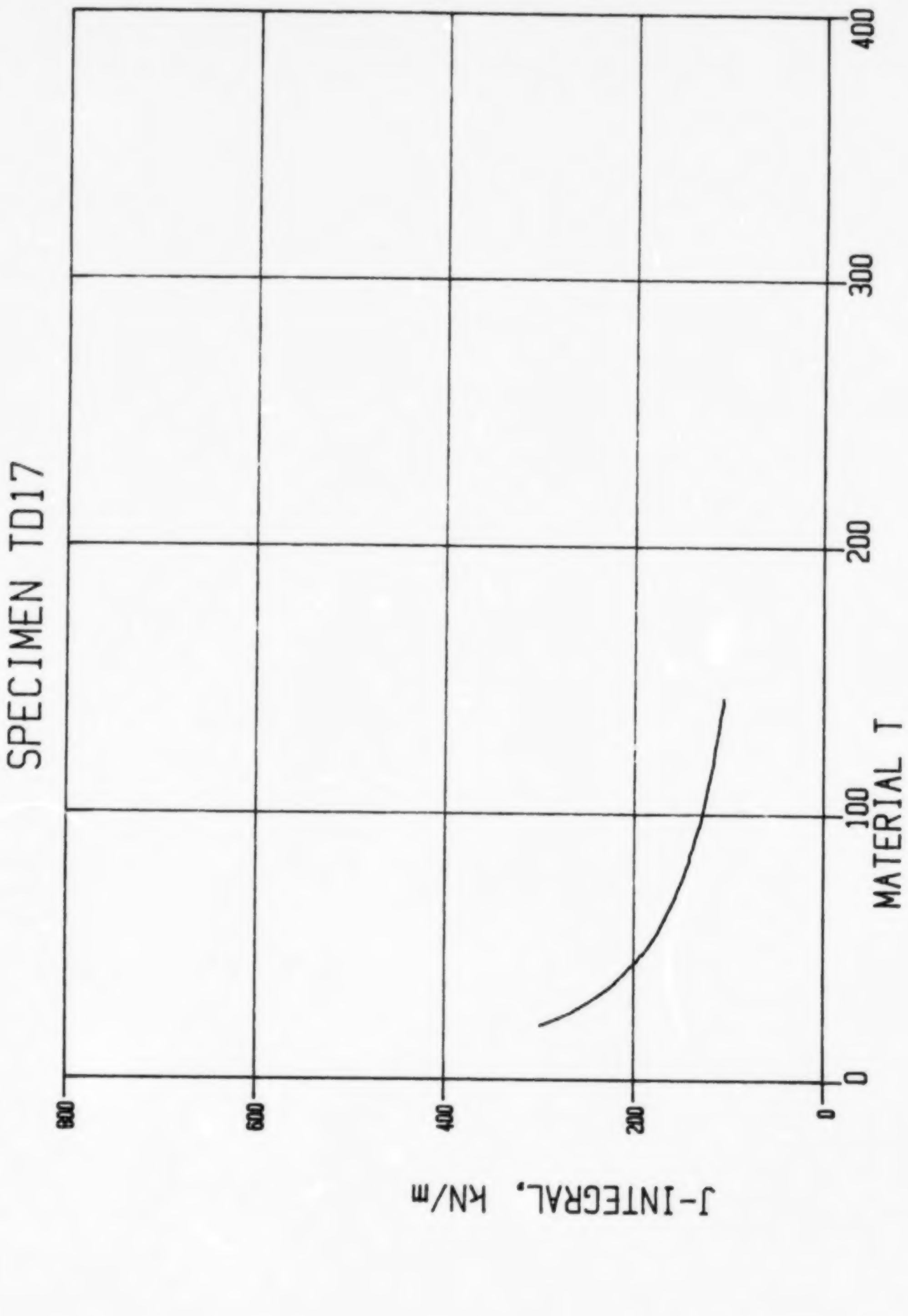
J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
.92	3.587	3.587	.058	.9997	1
2.05	3.6	3.6	.192	.9998	2
3.78	3.586	3.587	.06	.9997	3
6.25	3.602	3.603	.218	.9998	4
9.72	3.587	3.588	.071	.9996	5
14.49	3.582	3.584	.028	.9998	6
20.91	3.576	3.578	-.032	.9998	7
29	3.575	3.578	-.029	.9999	8
38.87	3.571	3.574	-.068	1	9
50.16	3.58	3.584	.028	.9999	10
63.59	3.567	3.571	-.098	.9998	11
77.73	3.57	3.576	-.054	.9999	12
92.61	3.587	3.593	.118	.9998	13
109.24	3.602	3.609	.278	.9999	14
126.76	3.629	3.637	.559	.9999	15
145.22	3.657	3.666	.847	.9998	16
164.09	3.693	3.702	1.214	.9998	17
183.5	3.75	3.76	1.791	.9998	18
200.99	3.835	3.846	2.647	.9999	19
220.13	3.914	3.925	3.442	.9999	20
239.08	3.982	3.994	4.129	.9999	21
244.89	4.121	4.134	5.528	.9998	22

```
               LOAD(KN)      LOAD LINE DISPLACEMENT(MM)      TD16
 1              4.883         0
 2              8.057          .031
 3             12.085          .068
 4             15.93           .109
 5             19.836          .155
 6             23.621          .206
 7             27.1            .267
 8             30.212          .339
 9             32.898          .422
 10            35.217          .515
 11            37.231          .618
 12            38.94           .728
 13            40.466          .844
 14            41.748          .966
 15            42.725         1.097
 16            43.335         1.239
 17            43.701         1.387
 18            43.701         1.542
 19            42.969         1.716
 20            41.809         1.903
 21            40.039         2.104
 22            38.269         2.305
 23            36.438         2.496
```

	J(KN/M)	T	W	TD16
1	100.92	135.92	28.22	
2	118	82.19	14.45	
3	135.99	84.23	12.71	
4	154.65	67.75	8.87	
5	173.8	44.25	5.04	
6	192.25	26.89	2.68	
7	210.56	31.68	2.79	
8	229.61	36.26	2.85	
9	241.99	5.46	.38	


SPECIMEN TD17(300C)
SLOPE 46
INTERCEPT 98
J1C 104
J (KN/M)
0
100
200
300
400
500
600
700
800
900
1000
DELTA A (MM)
0
1
2
3
4
5
6
7
8
9
10


LOAD (KN)
0
10
20
30
40
50
60
LOAD LINE DISPLACEMENT (MM)
0
1
2
3
4
5
6
7
8
9
10
LEGEND
+ TD17 (ALL DATA)



SPECIMEN TD17

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     DATA SHEET-J1-R CURVE TEST

                 TEST SPECIMEN DATA

 SPECIMEN NUMBER                                      TD17
 MATERIAL TYPE                                        A106B
 MATERIAL CONDITION                                   PARENT
 TEST TEMPERATURE(DEG C)                              300
 MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)            223
 MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)          513.75
 CRACK PLANE ORIENTATION (PER ASTM E399)              L-C
 SPECIMEN THICKNESS B(CM)                             3.175
 PERCENT SIDE GROOVE                                  19.968
 SPECIMEN WIDTH W(CM)                                 6.359
 YOUNGS MODULUS AT TEST TEMP(Pa)                      1.7854E+11
 EFFECTIVE MODULUS(Pa)                                1.9915768E+11

                 FATIGUE PRE-CRACKING DATA

 MAX LOAD IN PRE-CRACKING(LAST 50%) KN                12.5
 MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM             18.65
 INITIAL CRACK LENGTH-COMPLIANCE(CM)                  3.618

                 CRACK LENGTH MEASUREMENT

 AVERAGE FATIGUE LENGTH 9PT(CM)                       3.731
 INITIAL A/W                                          .569
 AVERAGE CRACK EXTENSION 9PT(CM)                      .614
 DELTA A(CM) COMPLIANCE                               .63
 MAX DEVIATION OF SINGLE MEASUREMENT %                1

                 ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

 FIRST POINT                     13
 LAST POINT                      17
 JIC(KN/M)                       104
 CORRELATION COEFF               .91
 SLOPE M(MPa)                    46
 INTERCEPT B (KN/M)              98

                 VALIDITY(JIC)

 BN>25JIC/EFFECTIVE YIELD        YES
 LIGAMENT>25JIC/EFFECTIVE YIELD YES
 DJ/DA<EFFECTIVE YIELD           YES

                 QUALIFICATION OF R-CURVE DATA

 CRACK EXTENSION VALIDITY                             NO
 CRACK SIZE DA<0.15*DELTA A                           YES
 J(MAX)ALLOWED(BN*EF.Y./20) KN/M                      468.02
 OR J(MAX)ALLOWED(b*EF.Y./20) KN/M                    388.81
 DELTA A(MAX) ALLOWED(MM)(0.1*b0)                     2.741
 25*JQ/EF.Y.(CM)                                      .706

                 CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

 1st DATA POINT USED        13
 LAST DATA POINT USED       25
 CONSTANT(C1)               154.01
 EXPONENT(C2)               .3507
```

TD17(300C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.84	1.28	.03	1.3	1.3	1.37	3.618	1
22.84	2.66	.08	2.74	2.74	2.87	3.623	2
29.52	4.44	.35	4.79	4.79	5.01	3.631	3
35.48	6.42	1.4	7.82	7.81	8.16	3.596	4
42.06	9.02	2.93	11.95	11.97	12.4	3.628	5
47.02	11.27	7.26	18.53	18.54	19.1	3.623	6
50.48	12.99	14.14	27.13	27.07	27.82	3.602	7
53.35	14.51	22.81	37.32	37.18	38.11	3.592	8
56.66	16.36	32.29	48.66	48.75	49.5	3.613	9
59.87	18.27	42.62	60.89	61.32	61.78	3.634	10
61.14	19.06	56.93	75.99	75.87	76.99	3.608	11
64.22	21.02	68.75	89.77	90.59	90.79	3.642	12
66.02	22.22	83.54	105.76	106.77	106.82	3.648	13
68.15	23.67	98.38	122.05	123.97	123.13	3.67	14
69.66	24.73	115.18	139.91	142.61	140.99	3.686	15
73.03	27.18	127.68	154.86	161.8	155.86	3.761	16
73.66	27.66	147.91	175.57	183.27	176.54	3.772	17
76.01	29.45	162.81	192.25	204.53	193.12	3.833	18
76.18	29.58	183.58	213.16	227.84	213.91	3.862	19
78.88	31.71	196.72	228.43	249.26	229.11	3.926	20
78.77	31.62	216.07	247.69	275.23	248.06	3.991	21
81.07	33.5	227.06	260.55	298.24	260.8	4.077	22
80.01	32.62	246.88	279.5	324.9	279.39	4.138	23
81.32	33.7	257.66	291.36	348.42	291.09	4.221	24
80.47	33	278.08	311.08	372.2	310.61	4.248	25

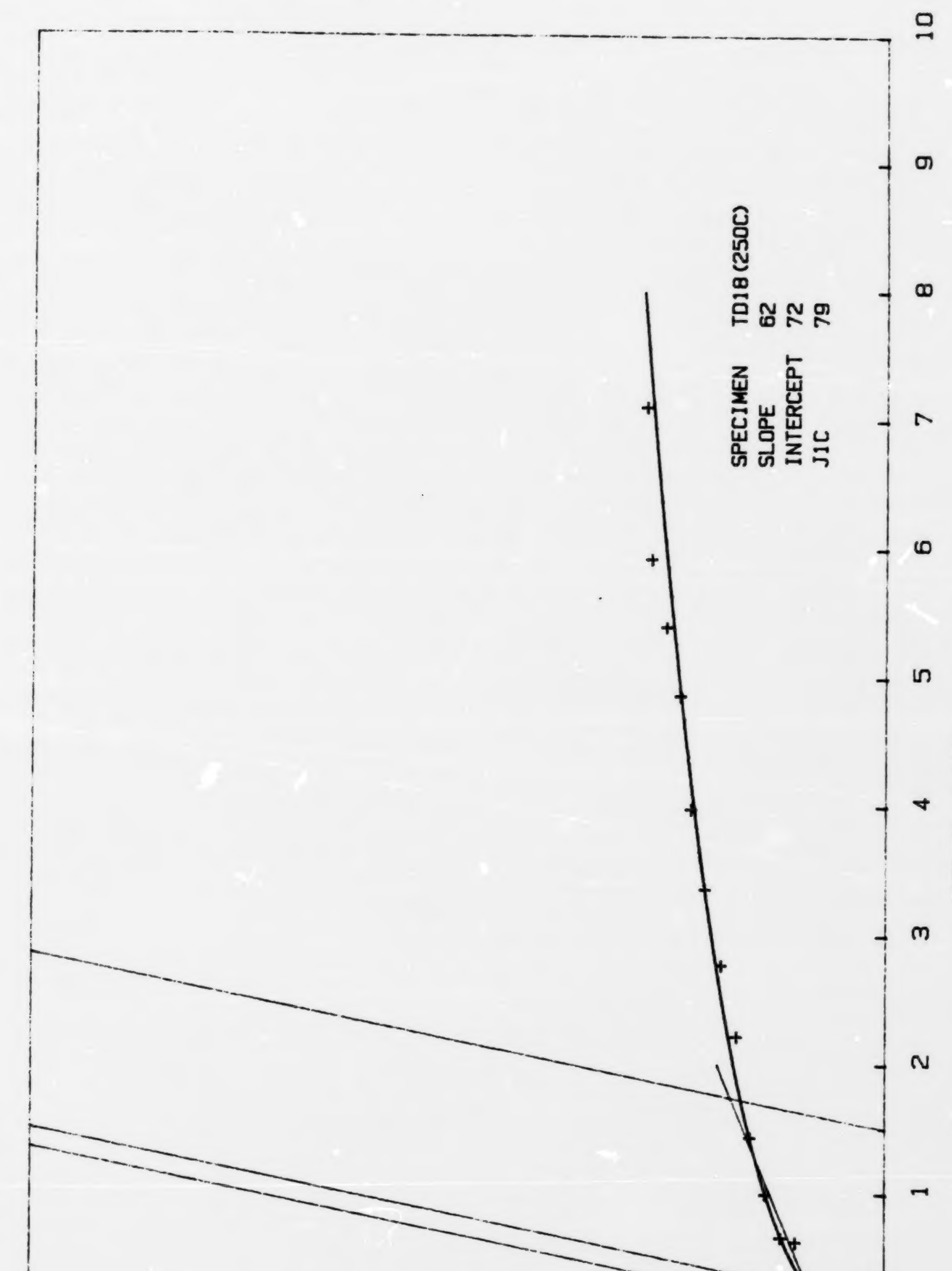
H(M)	D(M)	POISSON'S RATIO
.02381	2.54E-03	.3

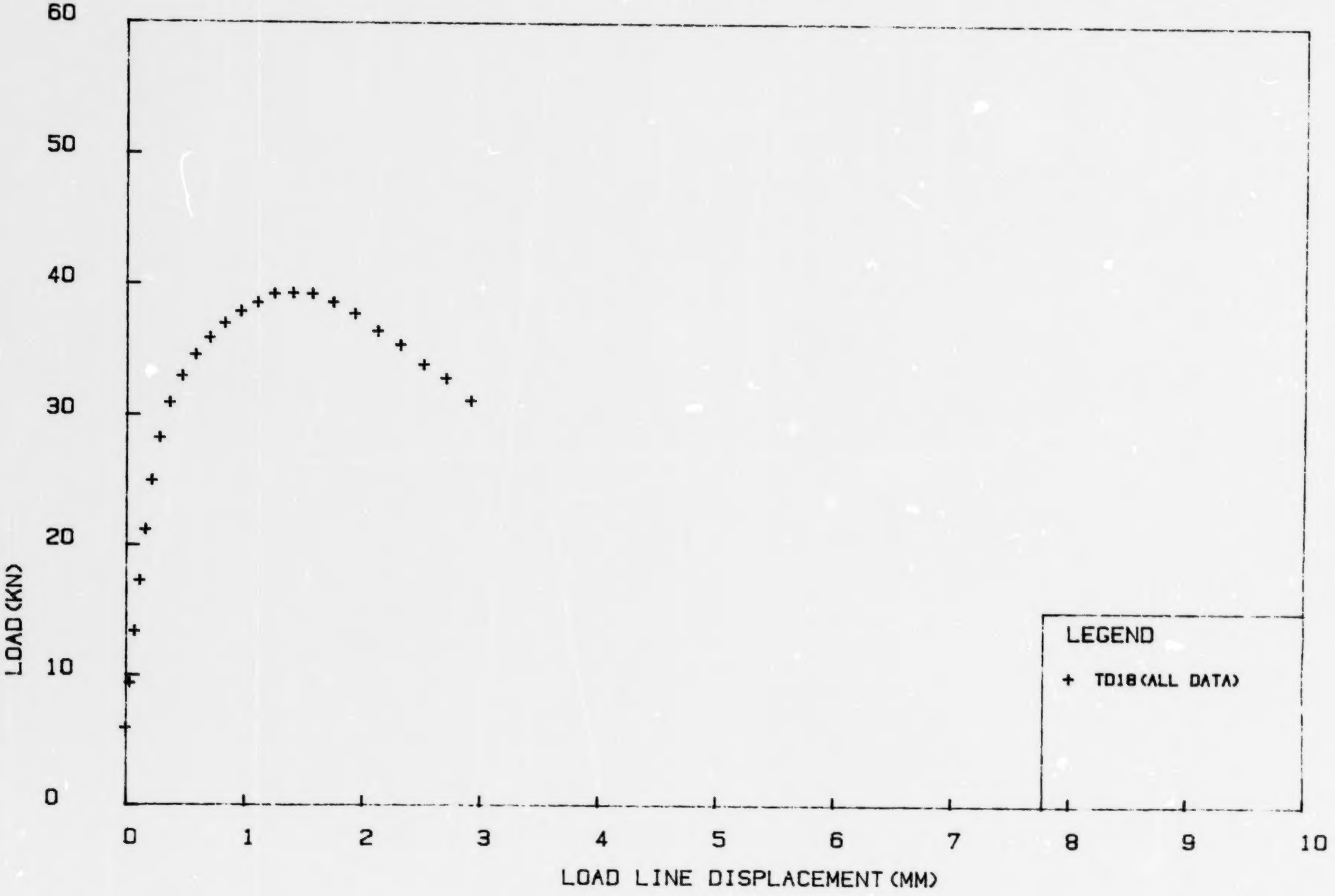
TD17

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.3	3.618	3.618	-2E-03	.9982	1
2.74	3.623	3.623	.051	.9981	2
4.79	3.63	3.631	.132	.9986	3
7.82	3.595	3.596	-.221	.9976	4
11.95	3.627	3.628	.099	.9983	5
18.53	3.621	3.623	.045	.9982	6
27.13	3.6	3.602	-.159	.9993	7
37.32	3.589	3.592	-.262	.9982	8
48.66	3.609	3.613	-.055	.9988	9
60.89	3.629	3.634	.16	.9988	10
75.99	3.602	3.608	-.102	.9994	11
89.77	3.636	3.642	.237	.9991	12
105.76	3.641	3.648	.297	.9993	13
122.05	3.662	3.67	.517	.9987	14
139.91	3.677	3.686	.68	.9987	15
154.86	3.751	3.761	1.425	.9987	16
175.57	3.762	3.772	1.543	.9984	17
192.25	3.822	3.833	2.155	.9996	18
213.16	3.85	3.862	2.44	.9996	19
228.43	3.914	3.926	3.085	.9956	20
247.69	3.978	3.991	3.727	.9996	21
260.55	4.064	4.077	4.594	.9989	22
279.5	4.124	4.138	5.203	.9987	23
291.36	4.207	4.221	6.032	.9981	24
311.08	4.233	4.248	6.3	.9999	25

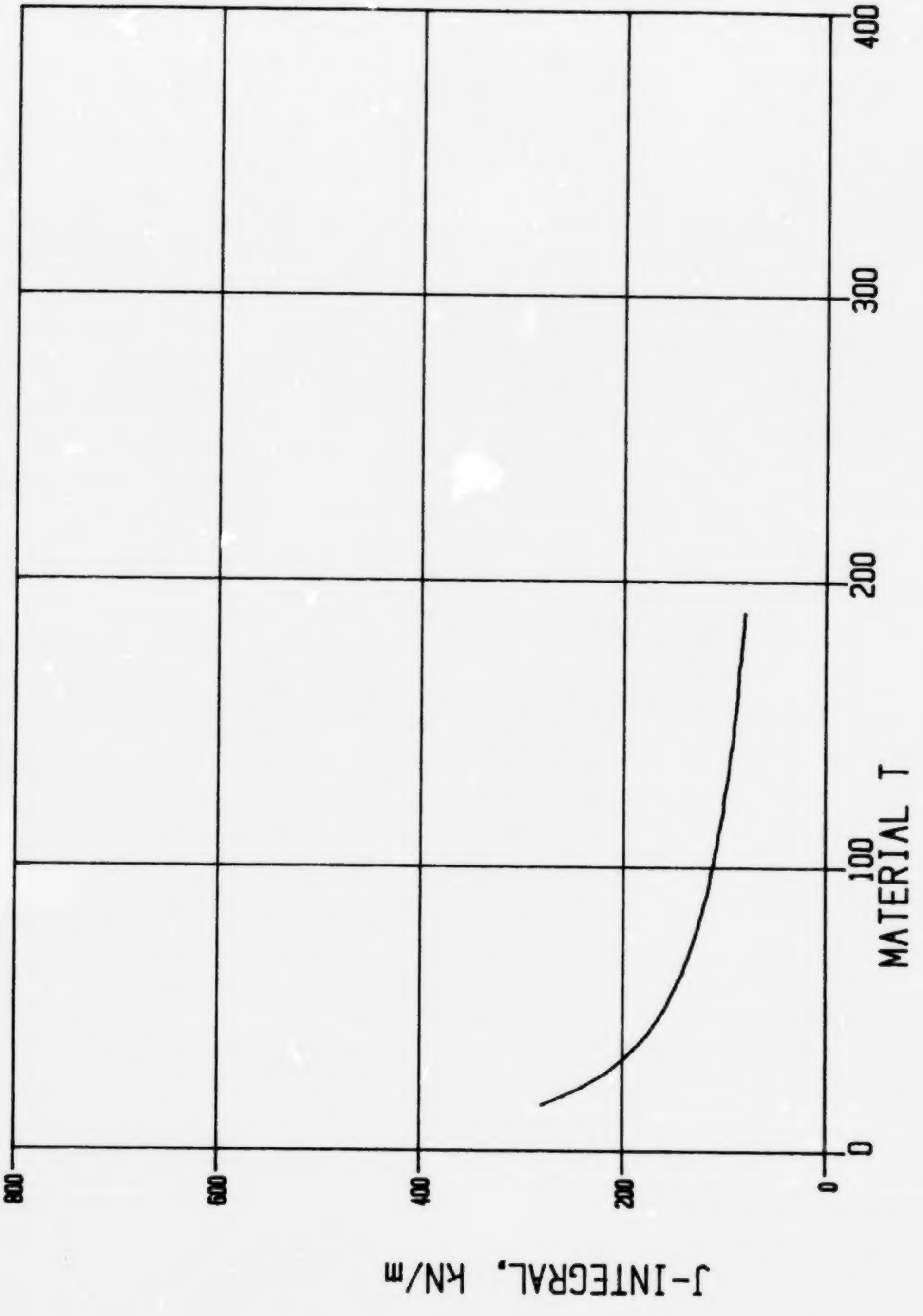
```
          LOAD(KN)     LOAD LINE DISPLACEMENT(MM)     TD17
 1         5.981        0
 2         9.338         .034
 3        13.428         .076
 4        17.273         .12
 5        21.179         .168
 6        24.658         .229
 7        27.649         .309
 8        30.029         .4
 9        31.921         .503
 10       33.508         .618
 11       34.973         .736
 12       36.255         .861
 13       37.354         .991
 14       38.269        1.125
 15       39.001        1.267
 16       39.49         1.416
 17       39.612        1.577
 18       39.673        1.741
 19       39.429        1.912
 20       38.818        2.09
 21       38.574        2.262
 22       36.926        2.468
 23       35.828        2.661
 24       33.875        2.877
 25       32.41         3.081
 26       31.433        3.273
```

	J(KN/M)	T	W	TD17
1	97.76	349.66	73.71	
2	113.9	97.2	17.44	
3	130.98	144.58	22.43	
4	147.39	26.38	3.54	
5	165.22	232.27	27.64	
6	183.91	35.87	3.74	
7	202.71	96.35	9.02	
8	220.8	31.17	2.61	
9	238.06	39.42	2.98	
10	254.12	19.52	1.33	
11	270.03	40.95	2.56	
12	285.43	18.82	1.07	
13	301.22	96.68	5.15	


SPECIMEN TD18 (250C)
SLOPE 62
INTERCEPT 72
J1C 79
J (KN/M)
DELTA A (MM)
0
100
200
300
400
500
600
700
800
900
1000
0
1
2
3
4
5
6
7
8
9
10


60
50
40
30
20
10
0
LOAD (KN)
0
1
2
3
4
5
6
7
8
9
10
LOAD LINE DISPLACEMENT (MM)
LEGEND
+ TD18 (ALL DATA)

SPECIMEN TD18



DATA SHEET-J1-R CURVE TEST

TEST SPECIMEN DATA

SPECIMEN NUMBER	TD18
MATERIAL TYPE	A106B
MATERIAL CONDITION	PARENT
TEST TEMPERATURE(DEG C)	250
MATERIAL YIELD STRENGTH AT TEST TEMP(MPa)	228
MATERIAL TENSILE STRENGTH AT TEST TEMP(MPa)	510.8
CRACK PLANE ORIENTATION (PER ASTM E399)	L-C
SPECIMEN THICKNESS B(CM)	3.176
PERCENT SIDE GROOVE	20.182
SPECIMEN WIDTH W(CM)	6.362
YOUNGS MODULUS AT TEST TEMP(Pa)	1.82776E+11
EFFECTIVE MODULUS(Pa)	2.01770594E+11

FATIGUE PRE-CRACKING DATA

MAX LOAD IN PRE-CRACKING(LAST 50%) KN	12.5
MAX(K) IN PRE-CRACKING(LAST 2.5MM)MPARTM	18.42
INITIAL CRACK LENGTH-COMPLIANCE(CM)	3.599

CRACK LENGTH MEASUREMENT

AVERAGE FATIGUE LENGTH 9PT(CM)	3.709
INITIAL A/W	.566
AVERAGE CRACK EXTENSION 9PT(CM)	.702
DELTA A(CM) COMPLIANCE	.711
MAX DEVIATION OF SINGLE MEASUREMENT %	1

ANALYSIS-LEAST SQUARE LINEAR LINE(ASTM)

FIRST POINT	11
LAST POINT	16
JIC(KN/M)	79
CORRELATION COEFF	.91
SLOPE M(MPa)	62
INTERCEPT B (KN/M)	72

VALIDITY(JIC)

BN>25JIC/EFFECTIVE YIELD	YES
LIGAMENT>25JIC/EFFECTIVE YIELD	YES
DJ/DA<EFFECTIVE YIELD	YES

QUALIFICATION OF R-CURVE DATA

CRACK EXTENSION VALIDITY	YES
CRACK SIZE DA<0.15*DELTA A	YES
J(MAX)ALLOWED(BN*EF.Y./20) KN/M	468.21
OR J(MAX)ALLOWED(b*EF.Y./20) KN/M	379.03
DELTA A(MAX) ALLOWED(MM)(0.1*b0)	2.763
25*JQ/EF.Y.(CM)	.535

CURVE FIT J=C1*(DELTA A)^C2; J(KN/M);DELTA A(MM)

1st DATA POINT USED	11
LAST DATA POINT USED	24
CONSTANT(C1)	140.31
EXPONENT(C2)	.3425

TD18(250C)

K (MPaRTM)	J-ELASTIC (KN/M)	J-PLASTIC (KN/M)	JEL+JPL (KN/M)	J(M) (KN/M)	J(TO.AREA) (KN/M)	CR. LN (CM)	
15.84	1.25	-.01	1.24	1.24	1.29	3.607	1
22.65	2.55	.03	2.58	2.58	2.7	3.617	2
29.29	4.27	.37	4.64	4.64	4.85	3.618	3
35.73	6.36	1.13	7.49	7.49	7.81	3.609	4
42.74	9.1	1.98	11.08	11.09	11.53	3.635	5
46.93	10.97	5.96	16.92	16.88	17.51	3.581	6
51.82	13.37	11.15	24.52	24.52	25.21	3.595	7
55.49	15.33	19.6	34.93	34.98	35.7	3.605	8
58.38	16.97	29.89	46.85	46.94	47.7	3.608	9
59.55	17.65	43.54	61.2	60.86	62.16	3.579	10
62.95	19.73	54.57	74.3	74.9	75.25	3.624	11
64.11	20.46	70.35	90.82	91.13	91.85	3.613	12
67.09	22.41	83.03	105.43	107.4	106.43	3.662	13
68.39	23.29	99.62	122.91	125.02	123.94	3.666	14
69.85	24.29	116.4	140.7	144.45	141.67	3.699	15
71.58	25.51	132.7	158.21	164.49	159.1	3.743	16
73.77	27.1	147.43	174.52	186.01	175.23	3.821	17
74.68	27.76	165.08	192.84	208.52	193.37	3.877	18
74.77	27.84	184.04	211.88	232.6	212.15	3.935	19
75.67	28.51	200.17	228.68	255.47	228.76	3.997	20
76.89	29.43	212.34	241.78	278.14	241.65	4.085	21
77.38	29.81	228.26	258.07	300.76	257.76	4.139	22
76.2	28.91	246.92	275.83	325.36	275.2	4.191	23
76.12	28.85	253.48	282.33	348.84	281.56	4.31	24

H(M)	D(M)	POISSON'S RATIO
.02379	2.54E-03	.3

	LOAD(KN)	LOAD LINE DISPLACEMENT(MM)	TD18
1	5.92	0	
2	9.399	.032	
3	13.367	.071	
4	17.273	.115	
5	21.179	.162	
6	24.963	.215	
7	28.259	.28	
8	30.945	.364	
9	32.959	.469	
10	34.607	.581	
11	35.889	.702	
12	36.987	.83	
13	37.903	.964	
14	38.574	1.105	
15	39.246	1.245	
16	39.307	1.403	
17	39.246	1.565	
18	38.574	1.744	
19	37.72	1.926	
20	36.377	2.123	
21	35.339	2.313	
22	33.813	2.511	
23	32.776	2.701	
24	31.067	2.911	
25	28.381	3.142	

	J(KN/M)	T	W	TD18
1	82.56	-205.1	-50.98	
2	98.13	40.26	8.27	
3	114.17	651.57	114.89	
4	131.8	71.05	10.72	
5	149.45	53.49	7	
6	166.36	27.93	3.18	
7	183.68	44.35	4.48	
8	202.36	43.52	3.9	
9	220.28	36.25	2.91	
10	235.23	19.9	1.44	
11	249.93	40.94	2.72	
12	266.95	45.13	2.74	
13	279.08	7.35	.4	

TD18

J(KN/M)	CRACK LENGTH UNCORRECTED,cm	CRACK LENGTH CORRECTED,cm	DELTA A (mm)	UNLOADING CORR.COEFF	
1.24	3.607	3.607	.08	.9961	1
2.58	3.616	3.617	.176	.9978	2
4.64	3.617	3.618	.19	.9987	3
7.49	3.608	3.609	.096	.997	4
11.08	3.633	3.635	.357	.9985	5
16.92	3.579	3.581	-.183	.9992	6
24.52	3.593	3.595	-.036	.998	7
34.93	3.602	3.605	.06	.9973	8
46.85	3.605	3.608	.095	.9986	9
61.2	3.575	3.579	-.199	.9983	10
74.3	3.619	3.624	.251	.9963	11
90.82	3.607	3.613	.143	.9963	12
105.43	3.655	3.662	.629	.9978	13
122.91	3.658	3.666	.665	.9982	14
140.7	3.691	3.699	1.001	.9975	15
158.21	3.734	3.743	1.439	.9988	16
174.52	3.811	3.821	2.222	.9985	17
192.84	3.866	3.877	2.775	.9983	18
211.88	3.924	3.935	3.361	.9984	19
228.68	3.985	3.997	3.982	.999	20
241.78	4.073	4.085	4.863	.999	21
258.07	4.125	4.139	5.396	.9988	22
275.83	4.177	4.191	5.923	.9994	23
282.33	4.296	4.31	7.109	.9988	24

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